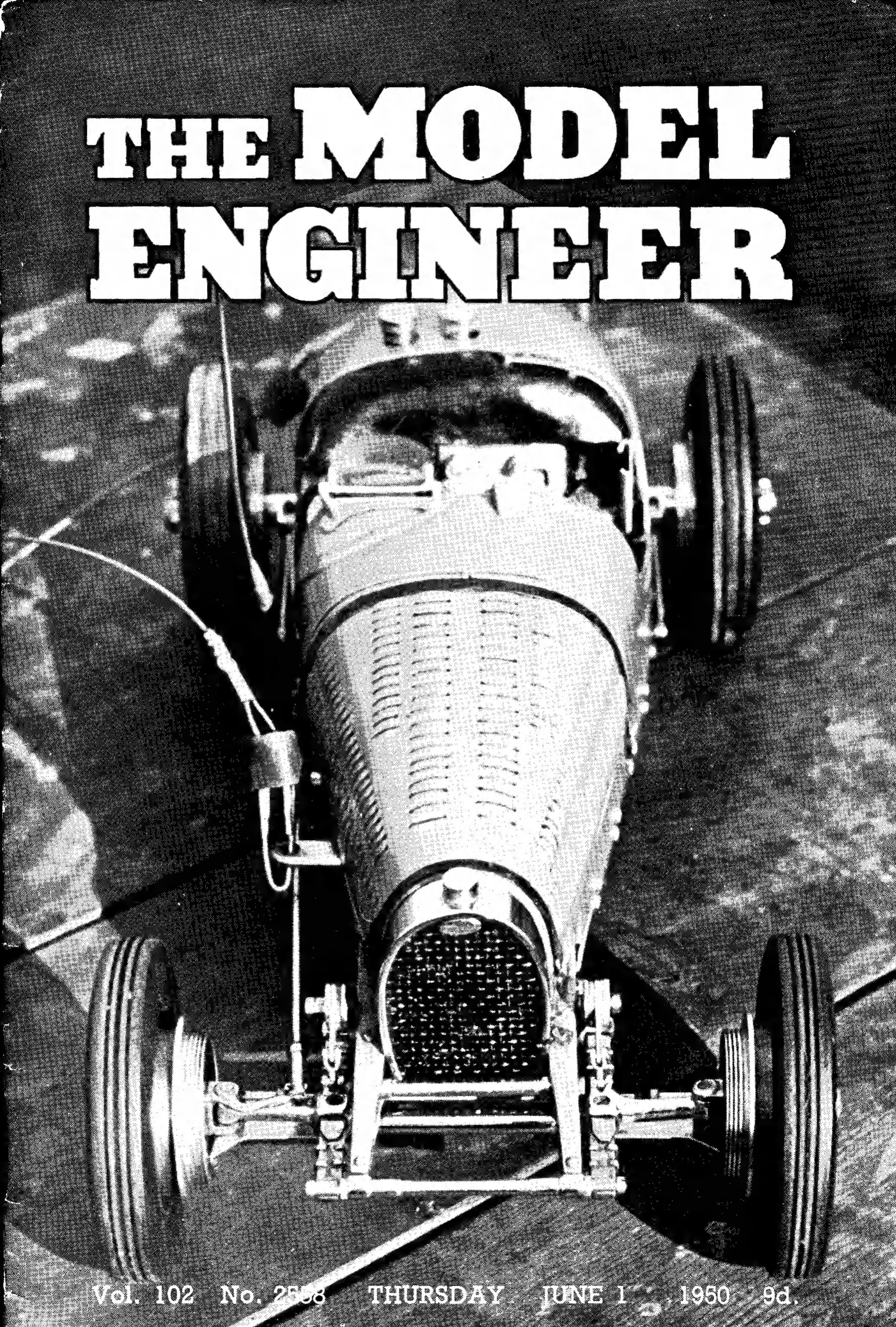
THE MODEL ENGINEER



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The MODEL ENGINEER

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IST JUNE 1950 VOL. 102 NO. 2558

SMOKE RINGS

Our Cover Picture

● OUR PHOTOGRAPH this week shows the magnificent array of front-end detail incorporated in the famous 10-c.c. engined Bugatti of Mr. W. P. Jones. Note the correct half-elliptic springs forming the suspension and the fully functional friction-type shock absorbers above. Note, too, the Ackerman steering, operative from the wheel in the cockpit. Correct "Bug"-type road wheels are employed.

By no means a newcomer to miniature motor racing, having been constructed by Mr. Jones in 1948, this model has achieved considerable success in a wide range of events and can boast an impressive speed for its type, in close proximity to the 100 m.p.h. mark.

Vickers' Annual Model Exhibition

● WE HAVE received news that the annual exhibition of the models section of Vickers Armstrong Ltd. (Weybridge) Social and Athletic Club will be held at Vickers' Sports Ground, Kings Head Lane, Chertsey Road, Byfleet, on Saturday, June 24th next, at 2 p.m. For the purposes of judging, the entries will be grouped in six sections : aircraft, cars, general engineering, locomotives, power-boats and sailing boats. The closing date for entries is June 20th.

We also understand that the section's multi-gauge track will be available for the running of steam locomotives in $2\frac{1}{2}$-in., $3\frac{1}{2}$-in. or 5-in. gauges.

Mr. W. G. Smith, hon. secretary of the Models Section, Vickers-Armstrong (Weybridge) S.A.C., Weybridge, Surrey, will be pleased to give any further information to enquirers.

The Gas Turbine Locomotive

● WE HAVE been privileged to make a detailed inspection of the gas turbine locomotive which was ordered by the Great Western Railway Company as far back as 1946 but not delivered to this country until February this year. The new locomotive was designed and built by the Swiss Locomotive Works, Winterthur, and it is generally similar to one built by the same firm in 1941. The design of both these interesting machines was developed by Messrs. Brown-Boverie, of Baden, Switzerland.

Compared with diesel and steam locomotives, the gas turbine seems to offer considerable advantages, due to the absence of the large number of moving parts, which should lead to a decrease in maintenance and give the locomotive a high availability.

In any event, the fact that the application of the gas turbine to railway traction has been developed into a reliable practical possibility in Switzerland, where electricity is the more normal source of motive power on the railways,

is extremely interesting; and when, following the war, the directors of the Great Western Railway turned their attention to the consideration of gas turbines for railway purposes, it is only natural that their chief mechanical engineer, Mr. F. W. Hawksworth, should be given the opportunity to inspect, in Switzerland, the first gas turbine locomotive ever to have been built.

It is probable that the British gas turbine locomotive, No. 18000, will be carefully watched for an extended period; meanwhile, delivery is expected shortly of a second example, designed and built by Metropolitan-Vickers Ltd. and Swindon Works in collaboration. When these two very interesting locomotives eventually go into regular service, their performance will be closely observed for a long time because, in spite of the apparent advantages of this type of prime mover, it has yet to prove itself fully capable of producing the expected results in operation and maintenance, as compared with other types of locomotive power. After all, this is a brand new type of locomotive for operating under British railway conditions, and everyone associated with it must have a very great deal to learn about it; so there is little, if any, justification for expecting it to revolutionise railway operation at once.

The Result of Learning

● IN A most interesting letter from Mr. W. Donnelly, of Transvaal, South Africa, there is a fairly lengthy description of the annual exhibition of models which is held at Johannesburg, in conjunction with what is known locally as the Agricultural Show, each Easter. This year's display seems to have maintained the highest standard of progress which is characteristic of the members of the Rand Society of Model Engineers, a body which is really made up of the amalgamation of a number of different clubs. We hope to receive, in due course, some photographs of models which were on view this year.

The main point of interest in Mr. Donnelly's letter, however, is the success which he gained with his model sailing ship, *Earl of Zetland*, which was awarded a trophy as well as the gold medal for the most outstanding model in the show, and the ship section's silver cup. This is success, with a vengeance! Mr. Donnelly writes: "I feel it was a bit unfair, possibly because I scored a lot of my experience in London. I learnt a lot there from Mr. Bowness and 'Jason'; for example, I had rigging on made of 'Mason's line.' This I immediately ripped off, on my return, built a rope-making machine, made ropes from black enamelled copper wire of about 26-gauge laid up in 3, 4 and 6 strands to give the various diameters for different shrouds, etc., just to quote one small point. Anyway, it shook them (the ship section of the R.S.M.E.) very badly, as it is the first time the ship section has collared the coveted gold medal."

We offer our sincere congratulations to Mr. Donnelly, and we hope he will let us have a photograph of his model; it seems to be a most outstanding piece of work. But we are most intrigued to note that, after first building the model, he was so impressed by what he learnt from our distinguished colleagues that he was prepared to go to the length of stripping down and remaking the rigging so as to correct what he had presumably decided were errors which he had made. Far from having his spirits quenched by the discovery of his mistakes, he is building a $\frac{1}{8}$-in. scale model of the four-mast barque, *Archibald Russell*, just to familiarise himself with the windjammers, because his main ambition is to build a really first-class model of one of the sailing men-of-war. We wish him all possible success.

Club Awards

● MR. J. A. KING, hon. secretary of the Welling and District M.E.E.S., has sent out an amended fixture-list for June 1950, and we are glad to note that a fairly full programme has been planned. We are, however, rather perturbed to note that Mr. King is not, apparently, receiving the support that he might have from the members. For example, he states that a shield was presented by Mr. Adamson for awarding annually to the maker of what is adjudged to be the best piece of work for the year. There was no award last year, because there were not enough entries. This kind of thing, we know, often worries club secretaries and committees, who find it somewhat disheartening. From their point of view, it may indicate a lack of enthusiasm on the part of the members of the society; on the other hand, it may be due to nothing more than forgetfulness, or possibly there is some prevalent dislike for assuming the honour.

As we see it, there are some factors that could well be borne in mind by everybody concerned. The donor of such a trophy is obviously endeavouring to encourage the production of good work, and his award involves, or should involve, some friendly competition among the active modelmakers in the society. This is all to the good, and we do not think that any sensible person could raise any complaints about it. If it does nothing else, it stimulates an active interest in the hobby; but it can scarcely fail to stimulate progressive improvement in workmanship. Whether the progress is slow or rapid depends entirely upon the enthusiasm of the members concerned, though, of course, it is influenced, to a greater or lesser degree, by domestic circumstances over which no society of hobbyists can have the slightest control.

But a timely memory-jog from the secretary can often achieve much, and we note with interest that Mr. King reminds his members that the Adamson shield will be awarded at a meeting to be held in October next, the reminder being sent out now so that, as he puts it, there can be no excuses for lack of entries this year. We hope that his warning will have successful results and that, in due course, we shall hear of a record number of entries.

Proposed Society for Dover

● WE LEARN from Mr. H. E. O. Turner that it is proposed to form a society of model engineers in Dover. Any readers in this area who are interested in the idea are asked to communicate direct with Mr. Turner at "Hardel," 62, Markland Road, Dover.

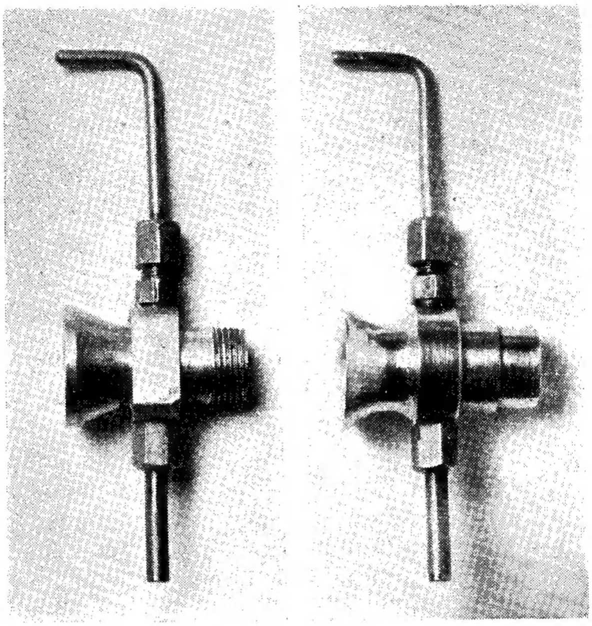
*The Elements of Maintenance

for 10-c.c. Racing Engines

by G. W. Arthur-Brand

SINCE the appearance of this type of motor, long strides have been taken in the direction of increased efficiency. Among the many discoveries which have been made is the fact that a 10-c.c. racing is capable of far greater aspiration than was at first realised, and in consequence, carburettors have been somewhat increased in bore.

If you will take a look at the original carburettor supplied with the engine under consideration, several points will become immediately obvious. For instance, coupled with the small bore, it will be noticed that the method of attachment to the rear crankcase cover calls for a threaded induction inlet with consequent detrimental effect upon the flow of the induced mixture, brought about by the fact that on none of these engines did the carburettor tube extend the full length of the internal threads. Also, for reasons of economical interest, very few tubes were true venturis, a point far more allied to optimum performance than is generally realised.



Left—The old carburettor as originally fitted to the engine. Right—Completely redesigned, but using the same jet and needle valve. The intake pipe has since been altered and is now as per drawing

To bring your motor completely up to date, therefore, and to relieve it of its existing shortcomings, let us redesign the carburettor.

The second photograph shows quite clearly how I have managed to eliminate the faults mentioned above, and although you cannot see it in the illustration, a true venturi has been formed by the inclusion of a 6 deg. taper in the forward end of the bore, which has been opened up to $\frac{3}{8}$ in. The mouth of the orifice has been enlarged to suit and a good polished finish has been attained, to cut skin friction to a minimum.

You will note, too, that the forward end, which fits into the crankcase cover, has been left unthreaded, a shoulder limiting the depth of insertion.

It will now be necessary to bore out the threads in the existing hole and open up to a size which will allow for a good tight press fit. This may be accomplished most satisfactorily by drilling or boring to the nearest 1/64 in. and reaming carefully to size.

I might mention here that while these operations are essential for optimum performance, they are not essential to reasonably good running and easy starting, and, should you be either inexperienced or at present satisfied with the existing performance of your motor, you are advised to leave these more advanced modifications until a later date. It is only fair to mention, too, that one of the effects of an enlarged induction is often to make starting more difficult. A highly tuned racing engine of *any* size is an extremely temperamental piece of machinery, the operation of which becomes increasingly involved the nearer it approaches its point of maximum performance. Once you appreciate this you may press on, but with due regard!

Before we pass on to the next operation, glance quickly at the photograph showing the modified rotary-valve and rear crankcase cover inlet, noting the smooth flaring to the full 90 deg., which will result in an uninterrupted flow of mixture for the complete period of induction.

Let us progress now to the cylinder-head. We can again make use of our home-made scraper, exercising the same care as we did with

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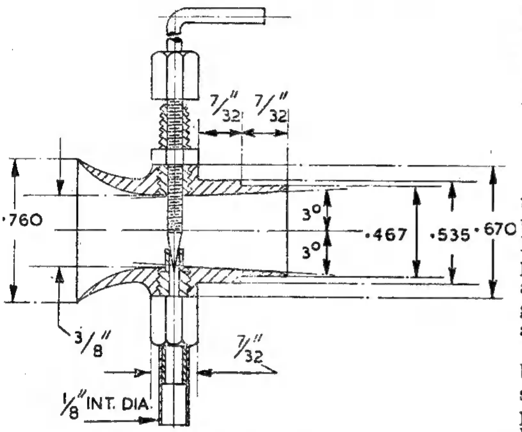
*Continued from page 742, " M.E.," May 25, 1950.

the piston top so as not to unduly lower the compression ratio by removing too much metal. Light, rapid strokes usually produce the desired effect, provided, of course, that the scraper is ground correctly in the first place and is kept well sharpened. Finish with fine emery and metal polish, after which remove all traces of abrasive matter by washing in clean petrol. During these operations avoid all possible risk of damage to the seating adjacent to the shaped portion of the head, as this will result in " blowing " when the motor is next run.

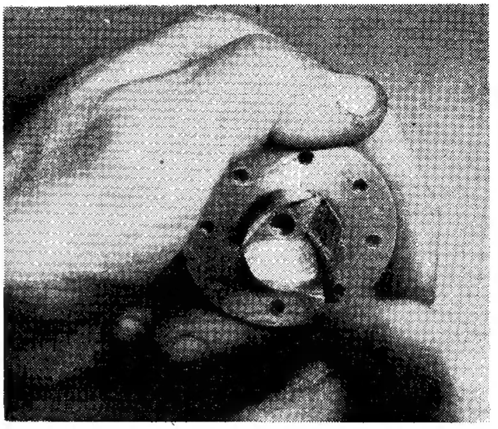
Finally, it occurs to me that, when dealing with the piston, I omitted to tell you how best to clean the piston-ring grooves. This may, to some, seem elementary, but when I explain that



Details of the new carburettor

I have seen this delicate operation carried out, on an alloy piston, with a hacksaw blade, you may understand my concern!

First, cut two pieces of cardboard of adequate

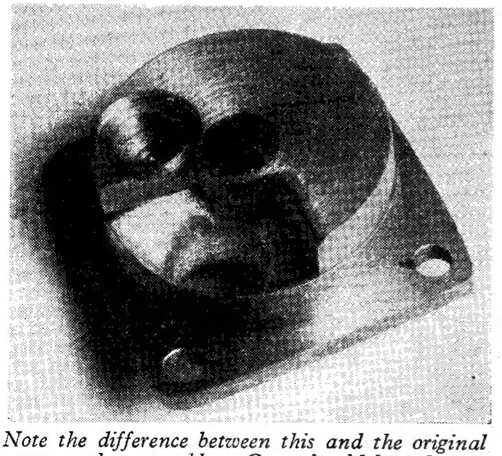


Employing the file tang scraper to obtain the desired finish in the head

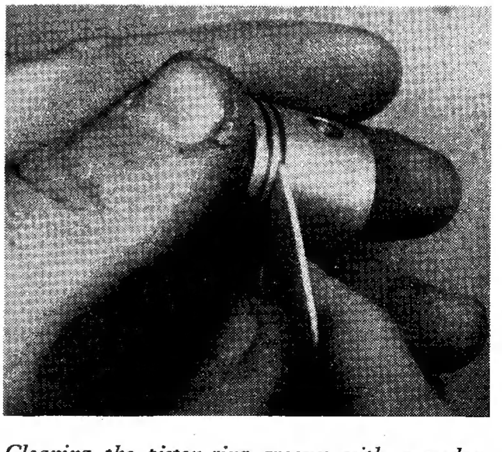
thickness to fill the grooves without forcing, and trim to the shape shown in the photograph. Now, use one as a dry scraper, revolving the piston so as to remove the greater portion of any fragments which may have entered the grooves, and finish off with the other dipped in a light oil as a cleanser. *Do not* use metal!

The complete reassembly of the motor will be shown in the final instalment of this series; so have ready a suitable receptacle, some clean petrol and rag and a spot or two of best quality light machine oil. And don't forget clean hands and a dust-free portion of the dining or kitchen table, as it is only through the observance of scrupulous cleanliness to the very end that we can hope for the results we have strived during these past weeks to attain.

(To be continued)



Note the difference between this and the original rotary-valve assembly. Care should be taken to compensate for the removed segment of the disc by enlarging the balancing recess on the rear face



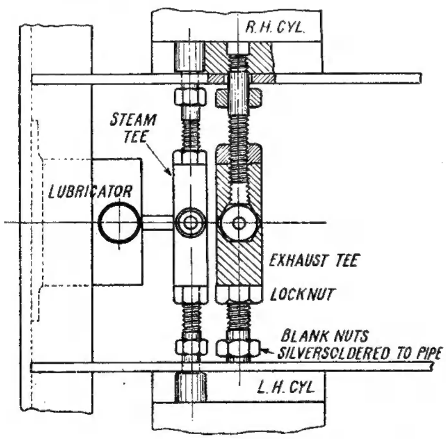
Cleaning the piston-ring grooves with a wedge-shaped cardboard scraper

"L.B.S.C.'s" Beginners' Corner

Steam and Exhaust Pipes for "Tich"

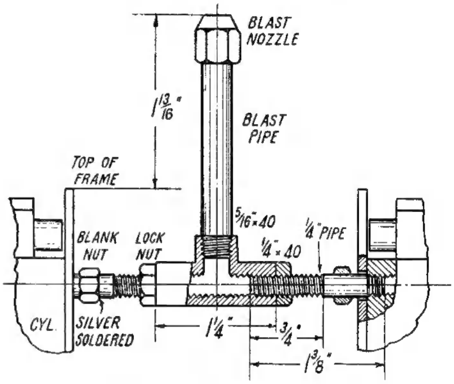
DURING my long experiences in little locomotive building, I have seen many weird and wonderful arrangements of steam and exhaust pipes, especially on commercially-made engines. Unions and flange joints in inaccessible places, bits of pipe soldered together, and pipes soldered direct into cylinders and steam chests, are only some of the troubles. One engine which I overhauled for an old friend had the whole of the pipes silver-soldered up into one unit, and it was some unit at that; the late lamented Heath Robinson couldn't have devised a conglomeration to beat it. It was attached to the cylinders by glands, not unions; and to remove it I had to disconnect the motion, take the cylinders off, and dismount the boiler! It is hardly necessary to add that the whole lot was scrapped, and replaced by a far simpler arrangement. What we need for *Tich* is something that can easily be made, easily fitted, and easily removed, if for any reason it is necessary to take it off; and the accompanying illustrations show a suitable layout. It is known on the other side of the big pond as "the plumbing"; and plumbing it certainly is, for it was originally suggested by a member of the fraternity who are reputed always to go back to fetch their tools.

Both steam and exhaust cross-connections consist of a central tee-piece which should be a



Plan of pipes erected on engine

casting, although tees can be built up; our approved advertisers will be able to do the needful. Connection between the tee-pieces and the cylinders are made by what our H_2O friends actually call "connectors"; that is, pieces of tube having a long screw thread on one end, and furnished with a locknut to suit. In the present instance, as there is room to spare between the frames of *Tich*, these connectors also have a blank nut silver-soldered to each of them, near the end of the thread, to enable them to be screwed home into the cylinders without the aid of a pipe-wrench or a "pair of footprints." Mention of that, calls to mind how the editor of a weekly illustrated journal once made himself



Exhaust pipe assembly

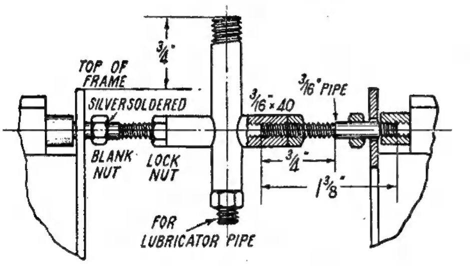
look very ridiculous. He was one of those people who are always trying to take a rise out of somebody or other, by virtue of "superior knowledge"—you know the sort—and reading in the local newspaper that an intruder had stolen, among other thing, a pair of footprints from a tool-shed in somebody's garden, he went into ecstasies over it, to the extent of half an editorial column, plus a "thumbnail cartoon" of Bill Sikes digging up a "Man Friday" type of footprint from the gravel in the garden path; and held up the reporter to scorn for his "ignorance." When his plumber and gasfitter readers promptly informed him that ignorance was bliss, and not only sent him pictures of the pipe wrenches stamped with the "Footprint" trade mark (hence the nickname) but several pairs of the actual implements, he had to print an apology; and it is hardly necessary to add that no further mention of tools was ever made in the editorial columns of that journal, which has long since ceased publication.

Exhaust and Blast Pipes

Let's take the exhaust first, as that is the easier of the two. The central tee-piece is machined up very similar to that on top of the feed pump, but with internal instead of external threads. Chuck in three-jaw by one of the longer sides, and set the outer end to run truly; face it off,

centre, and drill right through with 7/32-in. drill. If your $\frac{1}{4}$ in. × 40 tap is long enough, tap right through the piece; if not, tap about half-way. Take a skim off the outside, to true it up; then reverse in chuck, skim off the outside of the other end, to match the first, face off the end, and tap the other half. It doesn't matter about the thread not being continuous, for the cross pipes don't meet in the middle.

There should be a chucking piece cast on, opposite the stem of the tee. Chuck this in the three-jaw, and set the stem to run truly; then face off, centre, drill 9/32 in. to meet the cross hole, and tap $\frac{5}{16}$ in. × 40. Fine threads are needed for thin pipes. Cut off the chucking piece, and smooth the casting with a file. Should a casting not be available, use a piece of $\frac{3}{8}$-in. brass rod $1\frac{1}{4}$ in. long, facing, drilling, and tapping



Steam pipe assembly

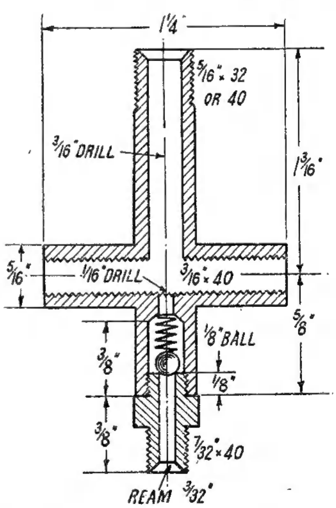
exactly as above. In the centre, drill a hole with letter N or 19/64 in. drill, as the blastpipe will have to be silver-soldered in; see below.

The two cross pipes, or connectors, are made from pieces of $\frac{1}{4}$-in. by about 22-gauge copper tube, each squared off at the ends, in the lathe, to a length of $1\frac{3}{8}$ in. On one end, the thread is $\frac{3}{16}$ in. long; on the other, it is $\frac{3}{8}$ in. long. Hold the tube in the chuck, and use a $\frac{1}{4}$ in. × 40 die in the tailstock holder, using plenty of cutting oil (same kind as used for turning steel) and pulling the lathe belt back and forth by hand to clear the chippings and get a clean thread. Threads in soft copper tear very easily indeed; but by screwing as stated above, and taking it easy, you should get quite perfect threads. Next, we want a couple of nuts "widout anny threads in thim, begorra!" says Pat. Chuck a piece of $\frac{5}{16}$-in. hexagon rod; face, centre, drill down $\frac{1}{2}$ in. or so with letter C or 15/64 in. drill, chamfer the corners, and part off a $\frac{1}{8}$-in. slice. Repeat performance, and if the parted off sides are burred, rechuck the other way around, and face that side too. To rechuck truly, quicker than I can write this, put the drill in the tailstock chuck with the nut mounted on it; advance the nut into the jaws of the self-centring chuck on the mandrel, close jaws down on nut, pull the tailstock away, and the nut is chucked truly. Enter the "lead" end of a $\frac{1}{4}$-in. parallel reamer just far enough to make the hole a tight push fit for the $\frac{1}{4}$-in. cross pipe; push same in until the shorter screwed end projects $\frac{3}{8}$ in. beyond the nut, after which, silver-solder the nut to the pipe. You should be quite an expert at silver-soldering by now, so I need not detail out that job. The locknuts are made the same way, except that they are drilled 7/32 in., and a $\frac{1}{4}$ in. × 40 tap is run in instead of the reamer.

Put the locknuts on the longer threaded ends of the bits of tube, then anoint all the threads with some plumbers' jointing paste, and screw the longer ends of the connectors right home in the tee-piece. Now hold the tee-piece midway between the frames, with the stem of the tee pointing skywards, and the ends of the connectors in line with the tapped exhaust holes in the cylinders. Screw the connectors out of the tee into the tapped holes in cylinders, right to the end of the $\frac{3}{16}$ in. length of thread; a little spanner on the silver-soldered nuts will do this job to perfection. Then run the locknuts back against the ends of the tee, and tighten them well, but don't overdo it; threads in soft copper strip with little provocation. No packing or jointing is needed on the exhaust pipes. When the locknuts are tightened, the stem of the tee should be held vertically.

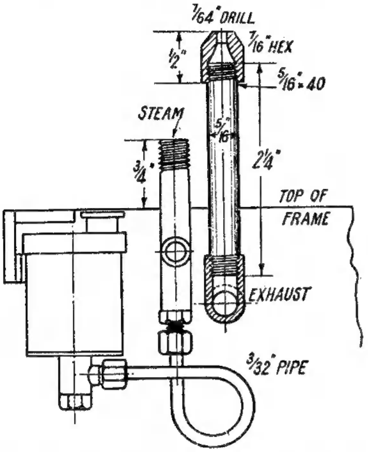
The blastpipe is a piece of $\frac{5}{16}$-in. by about 20-gauge copper tube, although it doesn't matter if a little thicker; the length is $2\frac{1}{4}$ in. A few threads of $\frac{5}{16}$-in. × 40 pitch are put on each end, by method described above, and the pipe screwed into the tee, as shown in the illustrations. The blastpipe nozzle, or cap, is made from $\frac{1}{2}$ in. of $\frac{7}{16}$-in. hexagon brass rod. Chuck in three-jaw, face, centre, and drill right through with 7/64 in. or No. 36 drill. Open out to $\frac{1}{4}$ in. depth with 9/32-in. drill, and tap $\frac{5}{16}$ in. × 40. Although not actually necessary, it is an advantage to "streamline" the inside of the nozzle, as

Combined steam tee and oil check valve



you get a little more "snap" to the blast without increasing back pressure; so if you feel inclined, make a little taper reamer by turning a cone point $\frac{3}{8}$ in. long on the end of a bit of $\frac{1}{4}$-in. round silver-steel about 3 in. long. File away half the diameter of the cone, finishing with a fine file. Harden by heating to medium red and plunging into clean cold water. Brighten up the flat part by rubbing it on a sheet of fine emery-cloth,

laid on the edge of your lathe bed, or anything else flat and true, taking great care not to round off the cutting edges. Lay it on a piece of sheet-iron, and hold it over the smallest ring of the domestic gas stove, or a Bunsen or spirit flame, to temper it. Watch it like a cat watching a mouse-hole ; as soon as the bright part turns yellow, pop it in the cold water again. A rub of the flat face on an oilstone, and it is ready for use. Ream by putting it in the tailstock chuck,



How the lubricator is connected

and feeding in same as a drill. Bear in mind the above instructions for making simple little reamers, for the same "technique" applies when making reamers for injector cones, plug cocks, and other components having taper holes.

If a piece of rod has been used instead of a tee casting, use a piece of $\frac{5}{16}$-in. tube for the blastpipe, same as above, but $2\frac{1}{2}$ in. long, and only screw one end of it. Ream the hole in the side of the piece of tapped rod, and slightly file the plain end of the pipe, until it can be pushed tightly into the hole, for about half the diameter of the rod ; then silver-solder it in. Pickle, wash, and clean up ; then put a 7/32-in. drill clean through the rod, to cut away the bit of tube projecting down into the hole through the rod. Also poke a drill down the blastpipe itself, to remove any burrs. Alternatively, a half-round notch can be filed across the bottom of the blast-pipe, and any burr scraped off it, before it is inserted into the hole in the rod. The same type of blast nozzle is used, as described above, and the assembly is erected in exactly the same way.

Steam Pipes

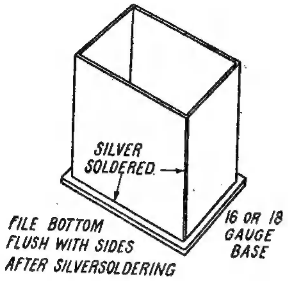
Whilst the steam pipe assembly bears a family likeness to the exhaust ditto, it differs in dimensions, and also carries the check valve for the oil supply from the mechanical lubricator. In any outside-cylinder engine with a single oil feed, the oil must be delivered at the point where the steam pipes diverge, otherwise one cylinder will get the lot, and the other one nothing at all, like the little pig in the nursery rhyme. A friend, now deceased, once brought to me an engine which had developed such a bad blow on one cylinder, that it was all she could do to pull her own tender. She was a $2\frac{1}{2}$-in. gauge job, made by a well-known firm, and cost nearly £60. The boiler was of the water-tube type, and spirit-fired. When I dismantled her, I found the trouble, *and* the cause of it, at one fell swoop. The left-hand cylinder was as dry as a bone ; portface, valve, and cylinder bore badly scored, and only a few fluffy fragments left in the packing groove in the piston. The cylinder apparently had received no oil from the time it left the works ; whilst its mate on the right-hand side was as in as good a condition as the workmanship on the job allowed. It had not apparently been short of oil at all.

The trouble was due to sheer ignorance, carelessness, or perhaps both, on the part of the mechanic who built the engine. The cross steam pipe between the outside cylinders was a straight bit of 5/32-in. pipe with a rough oval flange on each end, attached to the steamchests by screws. The lubricator was a plain displacement type located between the frames, behind the buffer beam ; and the pipe from this, was silver-soldered to the middle of the cross pipe. The trouble was the steam pipe connection. In a water-tube boiler, the steam pipe goes down between inner barrel and shell, at one side, and returns up the other side. Instead of bringing the end of the pipe around, and connecting it to the middle of the cross pipe, the mechanic had taken it straight to the cross pipe, and connected it close to the left-hand cylinder. Consequently, steam going to the right-hand cylinder, blew right past the end of the oil-pipe connection, and took all the oil with it. Naturally, the oil was unable to force a passage to the left-hand cylinder against the rush of steam, so the right-hand one got the lot. I reconditioned the cylinder (incidentally, had to do the other one as well, to keep both bores the same size) scrapped the pipes, and fitted an exactly similar arrangement to the one shown here, with a mechanical lubricator. I also fitted an oil burner, and did a few more oddments. The engine then worked very well, would do a spot of live passenger hauling, and continued to give every satisfaction.

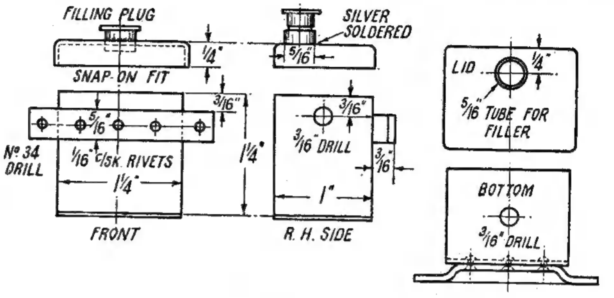
The ends of the tee carrying the cross steam pipes, are machined up in exactly the same way as the exhaust, excepting that they are drilled 5/32 in. and tapped $\frac{3}{16}$ in. × 40. The tee isn't really a tee at all, says Pat, because what was a chucking-piece on the other one (the exhaust) is utilised on this one as a check-valve for the mechanical lubricator ; see sectional illustration. Chuck it by that piece, see that the long end runs truly, then centre it deeply, and run a $\frac{3}{16}$-in. drill down it until same breaks into the cross passage at the bottom. Turn the outside to $\frac{5}{16}$ in. diameter, put a few $\frac{5}{16}$ in. × 40 threads on it with a die in the tailstock holder, and skim off any burring at the end ; but don't turn away the countersink. If your lathe happens to be on the flimsy side, bring up the tailstock to support the casting whilst you turn the outside of the long stem. The centre-point will fit the countersink.

Reverse in chuck and grip by the long stem. Turn the outside of the erstwhile chucking-piece to $\frac{5}{16}$ in. diameter, and face the end ; it should

project about $\frac{1}{2}$ in. from the crosspiece, but the exact distance doesn't matter a bean. Centre with a small-size centre-drill, and drill right through into the cross passageway with a $\frac{1}{16}$-in. or No. 52 drill. Open out to a full $\frac{3}{8}$ in. depth with a $\frac{3}{16}$-in. drill, slightly countersink the end, tap 7/32 in. × 40, and skim off any burrs. Chuck a piece of $\frac{5}{16}$-in. hexagon bronze or gunmetal rod in three-jaw; face the end, centre deeply

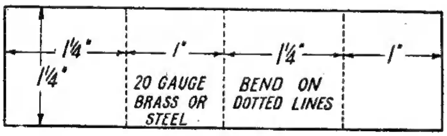


How to assemble oil tank



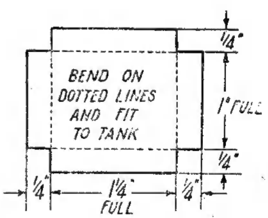
Tank for mechanical lubricator

(use letter E centre-drill for all small unions) and drill down about $\frac{5}{8}$ in. depth with No. 43 drill. Turn down $\frac{1}{4}$ in. of the outside to 7/32 in. diameter, and screw it 7/32 in. × 40. Part off at a full $\frac{9}{16}$ in. from the end. Reverse, and rechuck in a tapped bush held in three-jaw; you should know how to make a tapped bush by now. Keep all you make, and put a dot or figure at the point on the outside of the bush which was opposite to No. 1 jaw when the bush was first made; they can then be used again and again, and will always run truly. I have a box full of them, and find them very handy indeed. After rechucking, turn down $\frac{3}{16}$ in. of the other end to 7/32 in. diameter, and screw 7/32 in. × 40; put a 3/32-in. parallel reamer right through, then face off the end until you have just $\frac{1}{8}$ in. of full thread showing beyond the hexagon. If there is any sign of burring, put the reamer through the hole



How to mark out the oil tank

How to make the oil tank cover



again. I have described how to make simple small reamers from silver-steel, by filing off the end at a long slant, then hardening, tempering, and oilstoning; anybody with shallow pockets should make up a whole set of them, from $\frac{1}{16}$ in. to $\frac{1}{4}$ in.

Seat a $\frac{1}{8}$-in. rustless steel ball on the hole, same as you did when making the bottom fitting for the pump; then assemble in the same way, as shown in the illustration, but with this difference. The tiny ball is so light that it has a tendency to "float" in the thick cylinder oil, which is about the consistency of molasses or golden syrup when cold; so a weeny spring is added, to keep the ball seated when the pump in the lubricator is on the suction stroke. The spring is made from steel wire of about 26-gauge, coiled around a bit of 3/32-in. wire in the same way as when making the axlebox springs. Touch each end on the emery-wheel, when it is running fast, so that it bears fairly on ball and socket. The spring should be just starting to compress as the seating is screwed into the socket.

The fitting is erected in the same way as the exhaust fitting; put the locknuts on the long screws, smear all threads with plumbers' jointing, run the long threads into the tee, hold between the two steamchest bosses, making sure it is central, then running the connector pipes out of the tee into the bosses. Before tightening up the locknuts against the tee, put a few thin strands of asbestos string, or flax, between nuts and tee, tightening up securely, but not enough to strip the threads, which is easily done in soft copper. If a temporary adapter is screwed on to the stand-pipe of the steam tee, so that a tyre-pump can be connected to it, the chassis should dart all over the workshop floor when the pump is operated. If a first-time beginner holds one of the wheels between finger and thumb, and gives the handle of the pump a hearty push, he will get the shock of his life! Not many folk could hold the wheels against about 60 lb. air pressure, and novices will begin to realise why these little engines are capable of pulling such outsize loads.

Tank for Mechanical Lubricator

Now let us turn to a little bit of sheet-metal working. A mechanical lubricator is specified for *Tich*, because it is the most reliable, regular-

feeding oil supplier that I know of—and I have tried *all* the other kinds. It operates only when the engine is running, hence no waste. The faster the engine runs, the more oil it gets, a positive amount being delivered at each stroke of the pump. A little extra oil, to help a "cold start," can be injected into the steam pipe by simply turning the ratchet-wheel.

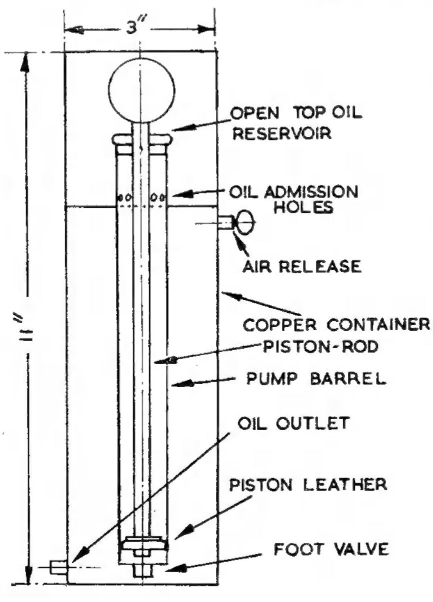
The pump is installed in a small oil tank attached to the front buffer-beam, so we will make the tank first. Cut out a piece of 20-gauge sheet brass or steel, a full $4\frac{1}{2}$ in. long by $1\frac{1}{4}$ in. wide; mark out as shown in the drawing, and bend on the dotted lines, to form a rectangle $1\frac{1}{4}$ in. long and 1 in. wide. If the corner persists in springing open, tie a bit of thin iron wire around the lot. Cut out a piece of 16- or 18-gauge sheet metal, same kind as body, about $\frac{1}{16}$ in. larger all around; see that this is perfectly flat. Stand it on the coke in your brazing pan, place the body on top, apply wet flux to the joints, blow to medium red, and touch the joints with a strip of medium-grade silver-solder, paying particular attention to the corner joint. Pickle, wash, and clean up. File the projecting bit at the bottom, flush with the sides. Drill a $\frac{3}{16}$-in. hole right in the middle of the bottom plate, and another in one of the shorter sides, $\frac{3}{16}$ in. from the top, and on the centre line.

Cut a strip of 16-gauge metal $\frac{5}{16}$ in. wide, and approximately $2\frac{1}{8}$ in. long; bend this to the shape shown in the bottom view of the tank, and attach it to one of the longer sides, at $\frac{3}{16}$ in. from the top. Hold in place with a small cramp whilst the holes are being drilled; countersink those in the strip. Use No. 51 drill, put $\frac{1}{16}$ in. brass or copper rivets through from the inside, hammer the shanks into the countersinks, and file flush. To give extra stiffness, the joint can be sweated with solder as well; put some liquid flux (Baker's fluid, killed spirits of salts, or any of the well-known proprietary brands) along each side of the joint, plus a small bead of solder. Hold over a gas or spirit flame with pliers, until the solder melts and disappears into the joint. Wash well in running water, to remove all traces of flux. Tip—keep a special old pair of pliers for jobs like these, as it will rust up your best pair. I use a little pair of home-made tongs, which I will describe when we come to the boiler-brazing job—very soon now, if all's well. Don't drill the No. 34 holes in the end tags yet; these are located from the buffer-beam.

For the lid, cut out a piece of metal, same kind as tank, a full $1\frac{3}{4}$ in. long and $1\frac{1}{2}$ in. wide. Scribe lines along all four sides, $\frac{1}{4}$ in. from the edge; cut out the corner bits, and bend to right-angles, on the dotted lines, to form a lid for the tank. It should be just a nice push-on fit. At $\frac{1}{4}$ in. from one of the longer sides, and in the middle, drill a $\frac{5}{16}$-in. hole, and fit a piece of $\frac{5}{16}$-in. tube about $\frac{3}{16}$ in. long, in it. Silver-solder this, and all the four corners, at one heat; but be extra sparing with the silver-solder, or the lid won't fit any more, due to blobs in the corners. Pickle, wash, and clean up; turn a little push-in plug for the filler tube, from $\frac{7}{16}$-in. brass rod, and the tank is all ready to have the "works" installed. I hope to give full details of these, in the next instalment of "Beginners' Corner."

A CONTINUOUS BURNING BLOWLAMP

by R. A. Briggs



THE ordinary blowlamp, primus or vaporising burner is limited in its action to the amount of oil in the container; when this is exhausted the burner fails and it may do so at inconvenient times, as, for instance, in the middle of a brazing job.

By the simple addition of a small reservoir, as shown on the sectional illustration herewith, the burner can be operated continuously for an indefinite period. The air pump common to all pressure vaporising burners has a cup leather piston and air admission needle-valve, which on the up stroke, allows air to pass through the piston into the pump barrel and is passed into the container on the down stroke. If a reservoir is fitted to the top of the pump, as shown, and charged with oil, oil will pass through the needle-valve and be forced into the container on the down stroke, thus replenishing the oil and at the same time raising the air pressure in the container.

The arrangement shown supplies oil under pressure to a vaporising burner under the boiler of my steam fire engine which has a $7\frac{1}{2}$-in. diameter boiler supplying steam at 100 lb. to 2 double-acting cylinders $1\frac{1}{2}$-in. × $1\frac{1}{2}$-in.

TRADE REVIEW

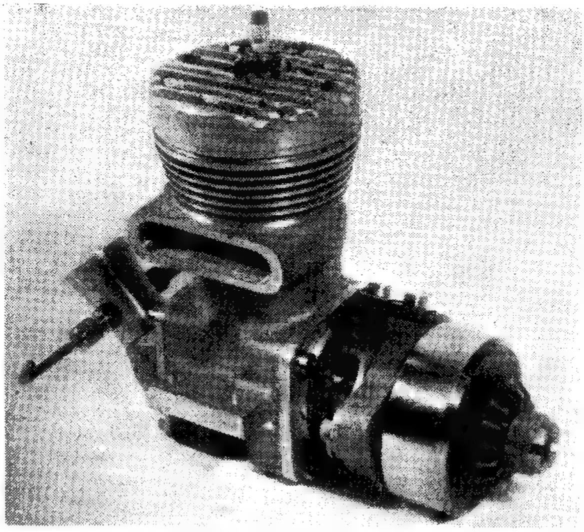
OUR first illustration shows the new Rowell "60" 10-c.c. racing engine. This unit has been considerably re-designed with larger transfer passage, improved porting, re-designed rotary-valve, new wide-bore down-draught carburettor and new-type lightened die-cast piston.

A considerable amount of development has taken place on this unit, and we hope in the near future to publish performance data which, it is anticipated will place it among the ranks of the most efficient engines in its class.

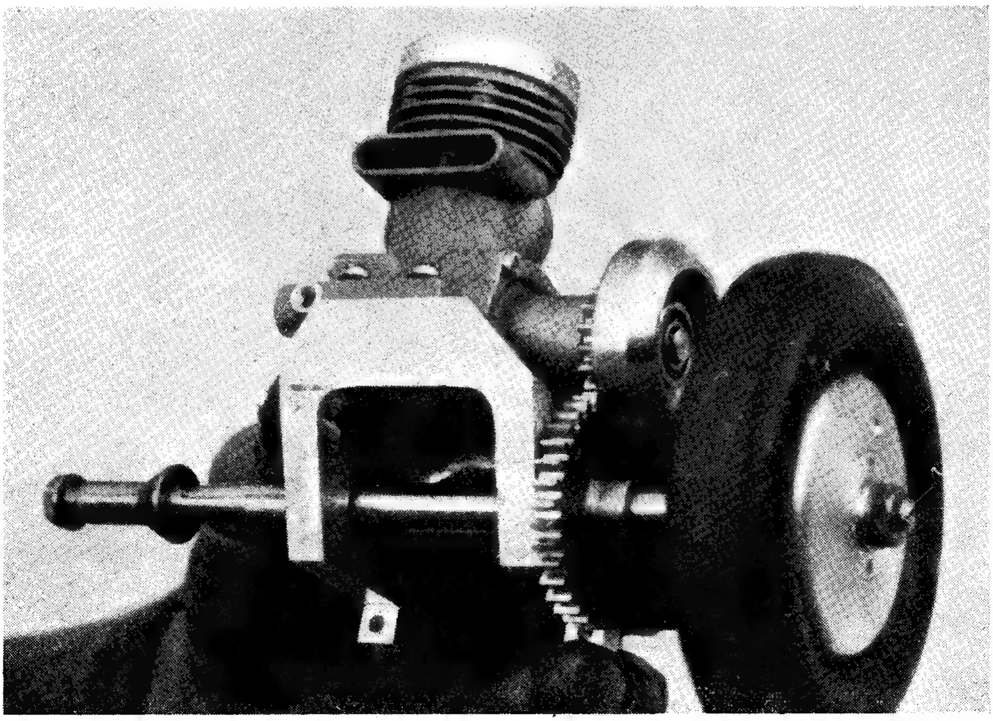
The manufacturers are Messrs. Rowell Motors Ltd., 93, Victoria Road, Dundee.

We have recently received the latest price list from Messrs. Z.N. Motors Ltd., of 904, Harrow Road, Willesden, London, N.W.10.

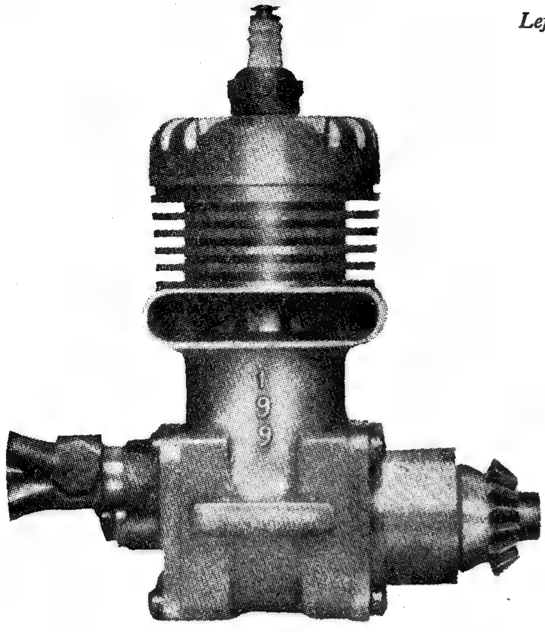
Among the many miniature race car components listed is the neat engine mounting for 5-c.c. power units



The latest Rowell "60" 10-c.c. racing engine

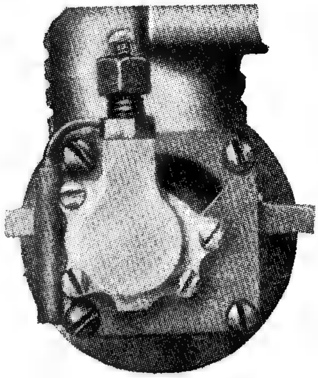


The latest Z.N. spur unit with Dooling 5-c.c. engine installed



Left—The American Hornet "199" unit

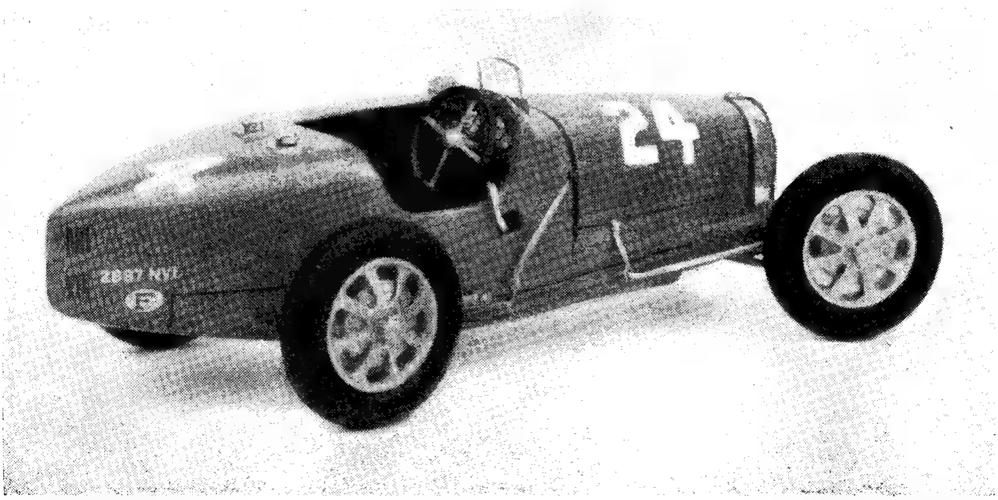
Below—A close-up of the Hornet fuel injector. Anyone know how it works?



shown here with the new Dooling "29" installed. It is a direct descendant of the original 10 c.c. version, designed for horizontal mounting, and bolts directly into any pan-type chassis.

The lists are priced at 6d., and may be obtained from the above address.

Over on the other side of the pond, the Hornet Motor Manufacturing Co., of Fresno, California, are producing a new "199" car, said to be capable of speeds in excess of 90 m.p.h. The power plant, illustrated here, follows usual practice, although the aircraft version of the same engine is fitted with an interesting fuel injection system. There appears to be no reason why this should not prove highly successful in the motor-car version, too!



As a slight contrast to the model Type 51 Bugatti, made in a hurry, which was described in the April 13th issue, here is a picture of another, and more pleasing Bugatti model which was more satisfying to the author and builder, Mr. C. Posthumus, time permitting more careful attention to proportions and detail

"Uncle Jim"

by J.N.M.

BY the death of Mr. James C. Crebbin—"Uncle Jim" to many hundreds of us—we lose not only the best-known of our many friends, but one more of that small number of distinguished enthusiasts who got together, early in 1898, for the purpose of founding the Society of Model and Experimental Engineers. In fact, I believe I am right in thinking that he was the last survivor of that little company. It is safe to say, however, that during the ensuing fifty-two years, nobody has worked harder in the cause of model engineering. He has devoted almost the whole of his spare time in the endeavour to popularise our hobby, and he saw to it that he became known personally to model engineers everywhere he went, which, especially in his later years, meant many parts of the world. He did not spare himself in his efforts, and he had the satisfaction of knowing and enjoying to the full the results of his endeavours in the cause to which he had devoted himself.

He was an intimate friend of the late Percival Marshall, and he was a generous benefactor to many of the clubs and societies which eventually began to come into existence after the S.M.E.E. had become so successfully established.

"Uncle Jim" was essentially a locomotive enthusiast, and although he was not an engineer by profession, he possessed a wide and intimate knowledge of the history and development of locomotive design. Compounding in locomotives particularly fascinated him; in fact, it was, at one time, almost an obsession with him. As a young man, he turned his attention to constructing miniature locomotives; after making one or two on more or less orthodox plans, he began a long series of experiments in miniature locomotive design. None of his models was a true-to-scale reproduction of any existing prototype; he preferred to work entirely "free-lance," because it seemed to him that this method offered the best chance of developing his ideas.

His first really successful miniature locomotive for passenger-hauling was completed in 1903 and, in its original state, was one of the most interesting ever built; it was a four-cylinder tandem compound Atlantic for 4½-in. gauge, and eventually became known far and wide as *Cosmo Bonsor*. Then came, at fairly long intervals, such well-known engines as *Aldington*, a four-cylinder simple Pacific; *Sir Felix Pole*, a four-cylinder de Glen compound 4-8-0, and *Sir James Milne*, a two-cylinder simple 4-6-0. Two others were purchased by Mr. Crebbin, to be considerably altered by him; these were: A remarkable 4½-in. gauge Mallet four-cylinder compound with the 2-8-0-0-8-2 wheel arrangement, and a 5-in. gauge two-cylinder simple 0-6-0 which he named *Ole Bill*.

It will be noted that, with the exception of the last-mentioned, these engines were named after celebrated railway managers who were among Mr. Crebbin's personal friends.

All these engines have been seen, often in steam, at model engineering exhibitions in many parts of Britain, as well as in France, Belgium and Scandinavia.

From early years, Mr. Crebbin was well known to railwaymen of all grades in this country and in France. He enjoyed unusual privileges in the matter of riding on the footplates of locomotives, especially on the Great Western Railway. Earlier, he had studied at first hand the working of the de Glen compound locomotives in France, acquiring an intimate knowledge of the behaviour and handling of these engines in varying conditions. In 1903, this knowledge stood him in good stead; at that time the first of the three French Atlantics acquired by the G.W.R. was on trial and, through his friendship with G. J. Churchward, Mr. Crebbin was able to ride the footplate of the engine and to give valuable practical advice to the crews who were learning how best to handle what was, to them, a brand new type of steam locomotive.

Mr. Crebbin was at Vitry, near Paris, to witness the testing of Sir Nigel Gresley's 2-8-2 locomotive *Cock o' the North*, in 1934, at that place.

However, it is to us who are closely associated with model engineering that Mr. Crebbin was most familiar; his tall frame and genial presence were known to thousands of us. I first came into contact with him in 1917, when a close friendship was quickly formed and has endured ever since. It was seldom that anyone meeting "Uncle Jim" for the first time failed to claim him as a personal friend ever after; for his genial nature radiated a warmth that was irresistible, and his generosity was often embarrassing. He made it his main ambition to be a kind of ambassador in the model engineering interest, and in this, he met with an astonishing success which, more than anything else, gave him unadulterated pleasure.

He was often critical of the work of model locomotive builders, but he endeared himself to all, because his criticisms were never destructive; they were always constructive, and very often, if any alterations were involved, the work would be done in his own workshop and sometimes by his own hands. An indication of his generosity in this respect, incidentally, is the frequency of his donations to THE MODEL ENGINEER Exhibition prize-list.

We have all lost a staunch friend, but we can see to it that the good work to which he devoted himself is allowed to live on and flourish. We shall miss his sunny presence at so many of our gatherings, though we can strive to keep his memory green.

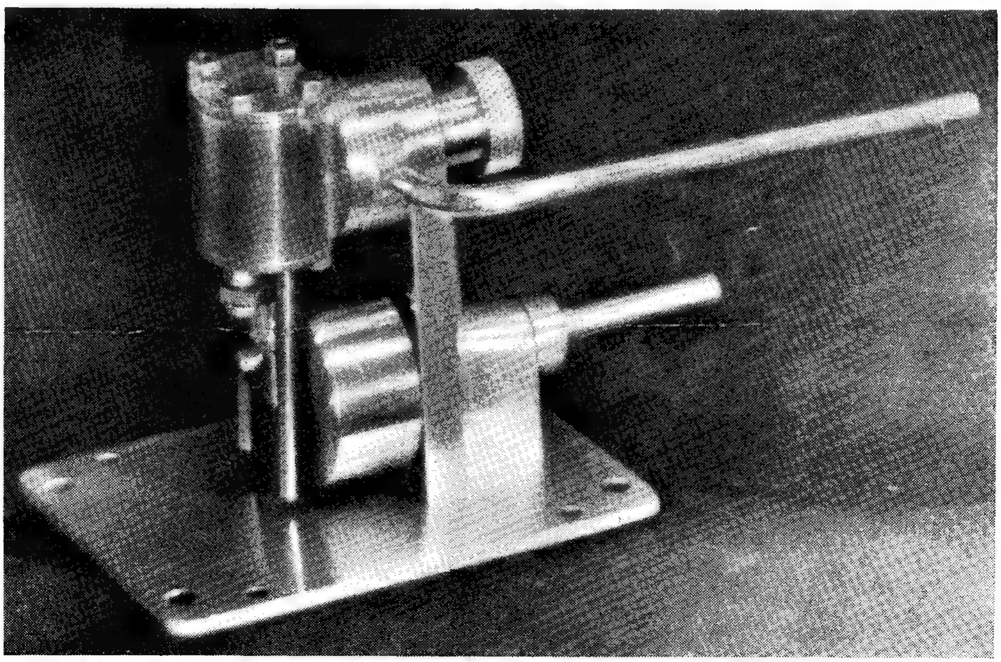
Model Engineering in the Middle East

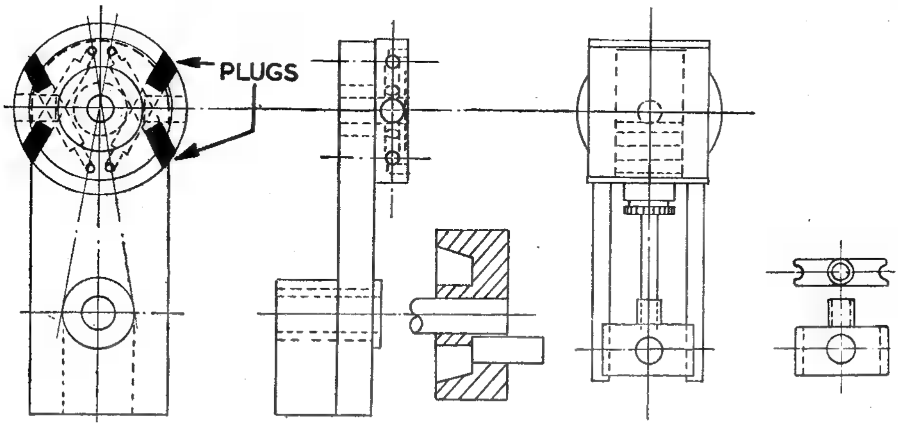
by R. Howe

THE formation of ■ model engineering Society at G.H.Q. Egypt (where I was stationed for two years) was a magnificent opportunity to widen my hitherto cramped style in the model engineering field.

During the first two months of our club's existence, our small group of enthusiasts spent the time in preparing that most vital feature of this wonderful hobby, the workshop. Our workshop in this case was contained in ■ Nissen hut, which most desirably, could be locked securely. Three nights weekly were spent at the club hut, and in my other spare time I engaged myself in designing and drawing out the two engines detailed below.

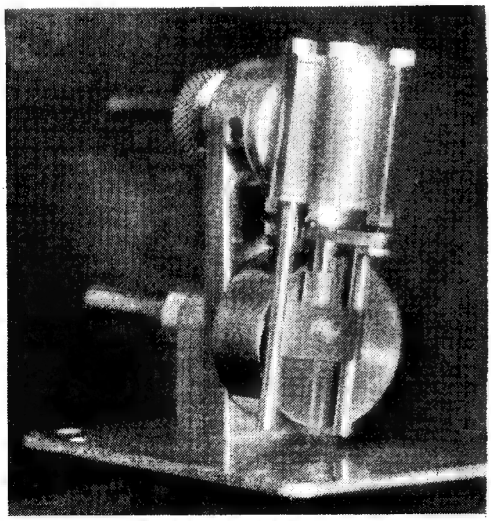
The oscillating engine was constructed first; it is $\frac{1}{2}$ in. bore, and $\frac{1}{2}$ in. stroke, and is of the double-acting type. The base, of steel, was originally a switch-box cover, the main frame was hacked out of a scrap piece of approximately 1 in. square aluminium bar, and is screwed to the base with four 4-B.A. screws. The crankshaft is ■ piece of $\frac{1}{4}$-in. silver-steel, which runs very smoothly in ■ brass bush 1 in. long, press fitted into the frame. My flywheel-cum-crankdisc is $1\frac{1}{2}$ in. diameter, and is recessed on one side only in order to retain sufficient material to hold the crankpin, which is a $\frac{1}{2}$ in. length of 5/32 in. silver-steel, pressed into the plain side. At this point I might mention our lathe; this was a brand new Churchill, 6 in. centres, inverted vee-bed, complete with tools, etc., but the trouble was that through the eleven months of my membership (I was then demobbed) this machine was never connected to the electricity supply, owing to the "red tape" which became entangled into the job. Therefore, anyone wishing to do ■ spot of turning had to pull round the lathe chuck with his left hand, and feed in the tool with his right hand. By this tedious method the aforementioned flywheel was machined in approximately $2\frac{1}{2}$ hr., ■ real "labour of love," as the usual day temperature was around 100 deg. F. The next part to be tackled was the valve face, entailing some careful work on the hand drilling machine. The sketch will be self explanatory. It will be observed, that both the inlet and exhaust ports are but ■ $\frac{1}{16}$ in. diameter hole, nevertheless this engine is very powerful and fast, running on ■ steam pressure of 10/15 lb. The valve face loading-spring was made from ■ piece of 1 mm. silver-steel by winding round ■ $\frac{1}{4}$ in. steel bolt, cut off to the maximum length required, and hardening and tempering being carried out with the aid of ■ blowlamp. The spindle supporting the cylinder is of $\frac{1}{4}$ in. diameter silver-steel, and is screwed $\frac{1}{4}$-in. B.S.F. for $\frac{3}{16}$ in. at the cylinder end, and





½ in. at the opposite end, for receiving the knurled adjusting nut. This nut is fitted with a 6-B.A. grub-screw which prevents the nut working back whilst the engine is running.

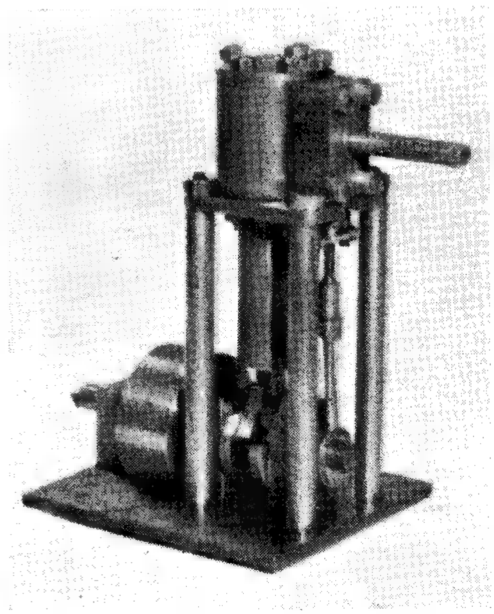
The piston is of dural, and has three fine grooves on the periphery for the purpose of retaining a small quantity of oil to lubricate the cylinder. It is mounted on the stepped piston-rod end, and is secured thereon by a 7-B.A. screw. The cylinder gland was packed with a



few strands of cotton (taken from a bandage) and a little oil into which some powdered pencil lead had been mixed.

Initial steam tests were made using a round cigarette tin, which was soldered up all over the joints, and fitted up with a length of ⅛ in. bore petrol piping leading from the top of the "tin boiler" to the engine, and a ¼-in. B.S.F. screw and nut for a filler plug. Heating was by a large paraffin blowlamp, and the tests were most successful.

My second attempt at model engineering was a slightly larger engine of ⅝ in. bore × ½ in. stroke, but this time I made the cylinder solid, (i.e. not oscillating). The bearings were cut from



¼-in. brass plate, and are split, with long 6-B.A. screws through the base of ⅛-in. mild-steel, and the top halves held down with 6-B.A. nuts. The crankshaft is built up, with the spindle of ¼-in. silver-steel and brass webs pressed into position and pinned, the webs are cut away for balancing.

Only a single eccentric is fitted, because, at

(*Continued on page* 789)

IN THE WORKSHOP

by "Duplex"

64—Fitting Flywheels and Gearwheels to Shafts

THE question often arises in the small workshop of the best means to employ when fitting and fixing a flywheel or gear wheel to its shaft. The answer must take into account all the various factors involved, including any

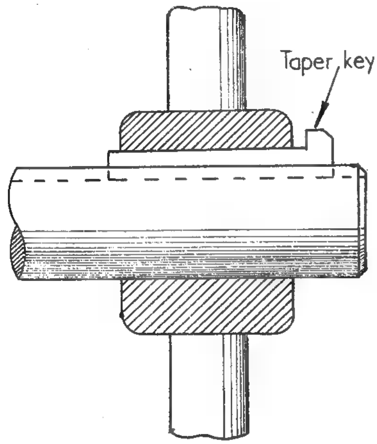


Fig. 1. *Method of fitting a taper key*

special requirement resulting from the particular working conditions. Thus, for example, true running and exact end-location are usually essential when mounting a gear wheel on a shaft; again, a flywheel may have to be fitted without materially weakening the shaft, or under certain conditions slip must be allowed to take place in order to save the mechanism from possible damage.

Tapered Keys

The old-time method of securing a wheel to its shaft was to use a key of the form shown in Fig. 1. The key, which has a head to facilitate driving-in and removal, fits closely in keyways formed in both the wheel and the shaft; moreover, the key is tapered in the vertical or radial plane to make it a driving fit. Although tapered keys of this pattern are still used in assembling agricultural machinery, and for securing the flywheels of large gas engines, they are seldom employed in general engineering as they have several disadvantages: the projecting head of the key may take up valuable space, and it is at times a source of danger in that it may catch in the clothing and cause injury to the machine operator. Further, to afford a satisfactory drive, the key must be accurately hand-fitted by a skilled mechanic. To lessen the work required in fitting, these keys are sometimes fitted as flat keys, that is to say the keyway in the shaft is dispensed with, and, instead, a flat is filed on the shaft. A variation of this type of key is the saddle key which has its base filed hollow to conform to the rounded surface of the shaft.

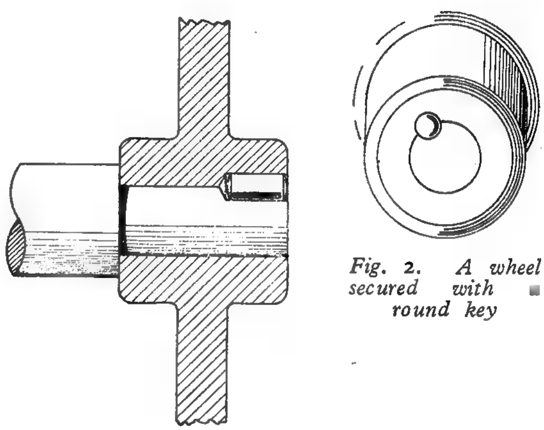


Fig. 2. *A wheel secured with a round key*

To give greater security, two or more tapered keys may be used, but this adds greatly to the work of fitting as it is essential that all the keyways should line up correctly. For heavy duty the length of the flywheel boss should be some four times the shaft diameter.

The round key, which is suitable for light duty only, provides an easy alternative method of securing a wheel to its shaft. As shown in Fig. 2, a hole is drilled half in the shaft and half in the wheel, and a well-fitting parallel or slightly tapered pin is then driven in. A firmer fixing

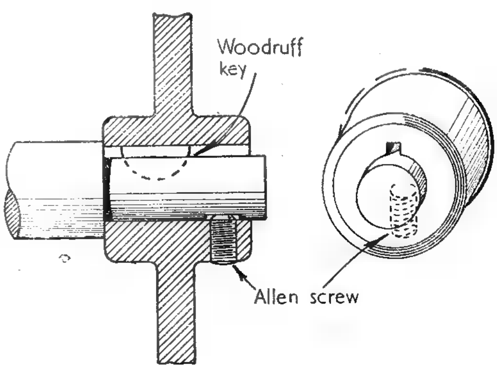


Fig. 3. *Wheel mounting with Woodruff key and Allen screw*

will be obtained if the hole is reamed slightly tapered to fit the tapered pin, but this will increase the difficulty of removing the wheel from the shaft, and it will probably then be found necessary to drill out the key.

Two pins are sometimes inserted on opposite sides of the shaft to distribute the load and give a more lasting hold.

The Woodruff Key

The plain tapered key has, however, been almost entirely superseded in machines by the Woodruff key, and examples of its application are shown in Figs. 3 and 4.

The key itself is part-circular in shape and is made in various thicknesses suitable for the kind of duty required. To take an example: a nominal ½ in. key has a height of ¼ in., less 3/64 in.; and as the key does not represent a full half-circle, the key seat can be machined to the full depth required by using a shanked, circular milling cutter.

Keys of nominal ½ in. diameter are made in standard thicknesses of 1/16 in., 3/32 in. and ⅛ in., and the use of the corresponding commercial milling cutter will ensure that the key is a good fit in the key seat thus formed. When machining a key seat with this type of cutter, held in the chuck, the shaft may conveniently be mounted on the lathe vertical slide, so that as the slide is fed upwards the cutter will form the key seat to the prescribed depth.

It will be clear that a Woodruff key, fitting in a keyway in the wheel, will not of itself provide end-location. End-location can, however, be obtained either by fitting an Allen set screw, as illustrated in Fig. 3, or preferably by pressing the wheel against a locating shoulder with a clamp nut, as shown in Fig. 4.

Examples from Automobile Practice

The method of fitting a wheel to a shaft by employing multiple splines, as illustrated in Fig. 5, gives a secure drive where heavy torque has to be met, and at the same time the pressure surfaces are kept large without greatly weakening the parts. This mode of construction is, however, rather beyond the resources of the small workshop, for the shaft splines are index milled with a cutter of special form, and the

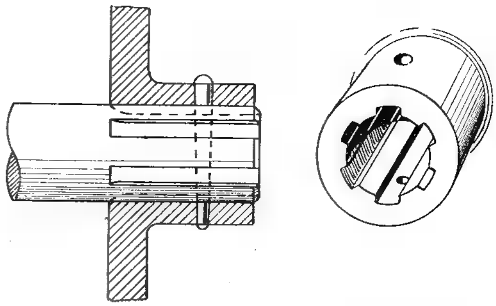


Fig. 5. A spliced wheel mounting secured with a taper pin

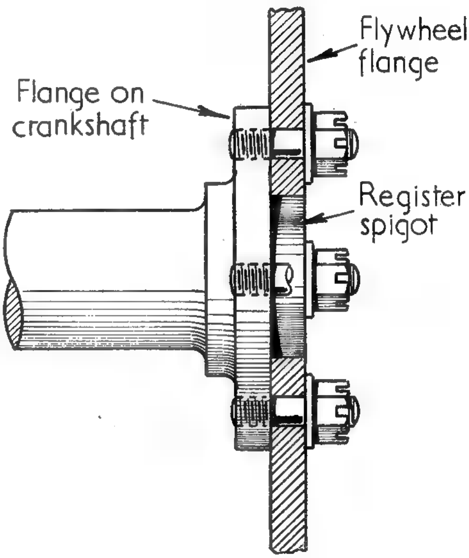


Fig. 6. Flange mounting for a heavy flywheel

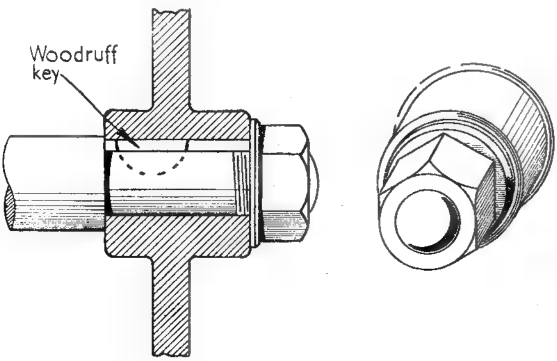


Fig. 4. A clamp nut fitted to maintain end-location

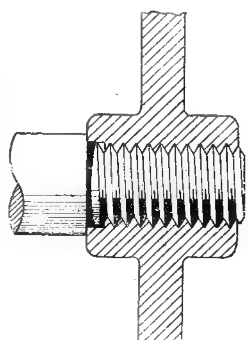


Fig. 7. A wheel mounted on a threaded shaft

wheel bore is machined commercially in a broaching machine.

As shown in the drawing, the parts after being pressed together are secured by means of a large taper pin, or for heavier duty a castellated securing nut is fitted to the end of the shaft and locked with a split pin. Motor car flywheels are sometimes bolted to a flange formed integrally with the crankshaft, as depicted in Fig. 6. The wheel must fit accurately on a register spigot, and dowel pins of large diameter are fitted to take the driving torque, for the studs shown in the drawing serve merely to hold the wheel in contact with the face of the flange. This form of construction, although suitable for large crankshafts carried in split bearings, would be out of place in a small single-cylinder petrol engine.

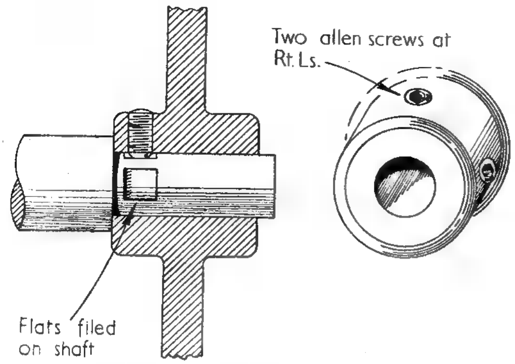


Fig. 8. Allen screws engaging flats formed on the shaft

Some Simple Wheel Fixings

Where the drive is in one direction only, the wheel, as shown in Fig. 7, may be screwed on to the threaded end of the shaft, just as a face-plate is mounted on the mandrel nose of a lathe. To ensure that the wheel will run truly, the threads should be screw-cut, and the abutment shoulder must be accurately faced. Although a locknut can be fitted to give a firmer hold, this form of mounting is never safe where the momentum of the wheel is great and the driving shaft is apt to be slowed down suddenly. The mounting of a large grinding wheel provided an example of the insecurity of this type of mounting. The electric driving motor fitted was so wired that, when the current was switch off, regenerative braking took place and the armature was stopped almost suddenly. The effect of this was that, on switching off, the armature came to a standstill, but the grinding wheel continued to revolve and unscrewed itself from the end of the spindle. The remedy on the electrical side is, of course, to alter the wiring connections of the motor so that it will not act as a dynamo when the controlling switch is opened.

Grub screws are often used for securing pulleys to shafts ; this is an easily fitted form of drive, and, although it will be found satisfactory for ordinary duty, it is hardly suitable for securing any but light flywheels, for fluctuations of torque in the drive are apt to loosen the hold of the screw. Allen screws are preferable for this work as they are more easily tightened, and the cratered form of the tip enables the screw to bite into the surface of the shaft and obtain a firm hold. It may be found, however, that the burr thus raised on the shaft makes the removal of the wheel difficult, and it is advisable, therefore, to file a small flat on the shaft at the point where the screw makes contact. These flats are best filed or machined towards the outer end of the shaft, as when situated near the inner end they tend to weaken the neck of a slender spindle. To lock a screw of this type, a short screw is first screwed home, and a second screw is then inserted on top of the first and firmly tightened.

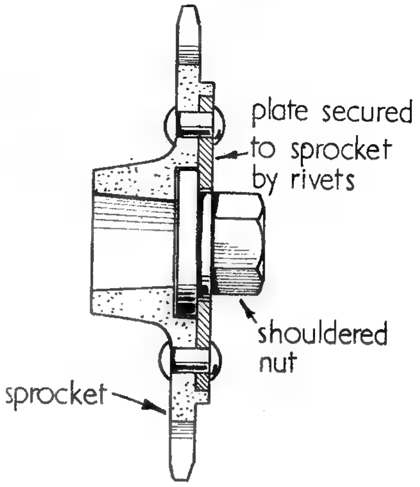


Fig. 9. The Triumph patent self-withdrawing magneto sprocket

A better driving hold will be obtained if two screws are fitted instead of a single grub screw ; it is then the usual practice to locate the screws at right angles to one another as shown in the drawing in Fig. 8.

Tapered Wheel Mountings

Where great accuracy in the wheel mounting is essential, a coned shaft and a corresponding tapered wheel bore are commonly used. If the machining is accurately carried out, a gear wheel or sprocket so mounted will not only run truly, but it will at the same time be end-located.

The taper is usually formed to an included angle of approximately 10 deg., and if a smaller angle of taper is used, the wheel may be found difficult to remove once it has been firmly seated. This form of mounting is commonly used for securing the magneto drive sprockets fitted to motor cycles, and the wheel is then pressed on to the taper by means of a clamp nut.

To alter the ignition timing, the sprocket must be loosened on its shaft, but a sprocket that has been securely locked on a tapered shaft may have to be drawn either by inserting wedges behind the wheel and then tapping on the end of the

shaft, or ■ small wheel-drawer may be employed for this purpose.

To overcome these difficulties and make removal of the magneto sprocket an easy matter, the Triumph Cycle Co., ■ long ago as 1909, patented ■ self-withdrawing sprocket and fitted it to their motor cycles. This device is illustrated in Fig. 9, and it will be seen that as the shouldered clamp nut is slackened, the screw thread will draw the wheel from the end of the shaft.

When machining the components of these tapered mountings, it will usually be found best to form the tapered bore in the wheel first, and then to fit the shaft taper with the aid of blue marking or by drawing longitudinal pencil lines; this will enable the points of contact to be easily detected, and the lathe topslide can then be reset accordingly. It should hardly be necessary to point out that both tapers must be machined with ■ tool set at exactly centre height, otherwise the parts will be turned barrel-shaped and proper mating contact will not be obtained. Wheels which have to be accurately located and at the same time secured against turning on the shaft are usually furnished with a key of the Woodruff type, ■ depicted in Fig. 10.

When the parts are correctly machined, this form of mounting gives ■ very secure hold, and it will be found most useful in the small workshop for fitting cams or gear wheels to the ends of shafts.

Cutting the seat in the shaft for the Woodruff key has already been described and should present no difficulty. The easiest way, perhaps, of cutting the inclined keyway in the wheel is to do this while the wheel is still mounted in the lathe for machining the tapered bore with the top slide set over. The boring tool is then replaced by a boring bar of the Nulok type, in which is mounted ■ tool bit, shaped like ■ parting tool and ground to the same width as the key. The lathe mandrel is now locked, and the tool, set at centre height, is drawn through the work and fed outwards, by means of the

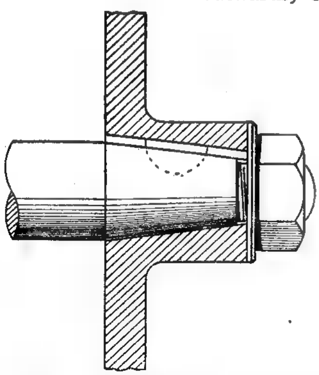


Fig. 10. Tapered wheel mounting fitted with a Woodruff key

cross-slide, until the keyway has been cut to the correct depth. It will usually be found that the tool will cut better and will have less tendency to chatter if it is pulled instead of being pushed on the cutting stroke; in addition, to avoid springing the tool, only light cuts should be taken. The tool can, of course, be moved to and fro by manipulating the top-slide feed screw, but ■ this is a rather slow and tedious proceeding, it is generally preferable to remove the slide's keep-plate and feed screw and arrange some form of lever feed, as has previously been illustrated and described when fitting the driving keys for ■ drilling machine spindle. It may,

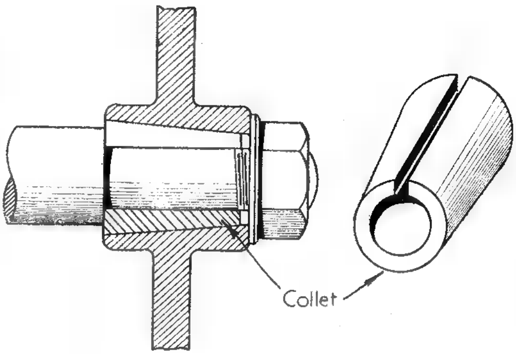


Fig. 11. A tapered collet mounting fitted with a compression nut

however, happen that a flywheel, already fitted to a machine, is too large to allow a keyway to be cut in this manner in the lathe. As ■ case in point, our 1902 Argyll car, equipped with a single-cylinder 6 h.p. M.M.C. engine, one day developed more than the usual amount of noise and vibration. This was traced to ■ slack clamping nut that had allowed the flywheel to become loose on its tapered mounting on the crankshaft. The keyway in the flywheel was in consequence much damaged and ■ new keyway had to be cut.

This was done with hammer, chisel, and file, and when the parts had been re-assembled no further trouble was experienced—at least in this portion of the driving mechanism.

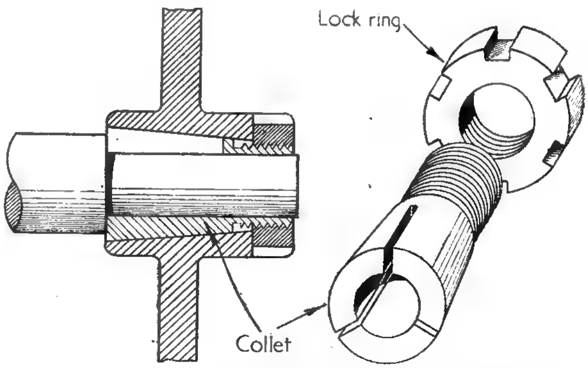


Fig. 12. A self-contained collet mounting

Collet Mountings for Flywheels

The form of collet mounting illustrated in Fig. 11 is favoured by Mr. E. T. Westbury for

securing the flywheels of some types of small internal combustion engines; it has the advantages that the shaft is not weakened by cutting a key-seat, and, in the event of a sudden stoppage or greatly increased loading, slip can take place which may save the parts from more serious damage.

The collet itself can be made of bronze, steel or cast-iron, and its external surface is machined to a taper amounting to an included angle of some 10 deg. The bore is formed parallel to fit the shouldered portion of the shaft, and a clamp nut is fitted to force the wheel on to the taper. The slit in the collet can quite well be made with a hacksaw. As the components of the mounting virtually form a solid piece when the clamping pressure is applied, it is essential that the parts should be accurately fitted in order to ensure that uniform contact is established and a secure drive thus obtained.

The collet mounting shown in Fig. 12 is of rather more elaborate construction and forms a driving unit in itself; the shaft, therefore, need only be machined with a parallel, shouldered portion. The only difficulty likely to be encountered is the cutting of the three radial slits which allow the collet to contract on to the shaft, just as a lathe mandrel collet closes when gripping the work. This slitting operation has been successfully carried out on many occasions by mounting the finished collet on a stub mandrel, and then cutting the slits with a fine milling saw driven from the lathe overhead. Either the mandrel indexing attachment or a change wheel fitted to the tail of the mandrel can be employed for indexing the work.

Here again, accurate machining is essential if a true-running wheel and a secure form of drive are to result.

A further modification of this form of drive is illustrated in Fig. 13. This mounting was used to secure the flywheel to the crankshaft of a 1 h.p. workshop petrol engine. The flywheel itself originally belonged to a four-cylinder car engine and was furnished with a tapered bore and keyway. As the bore of the flywheel was much larger than the diameter of the crankshaft, it was decided to use a collet mounting, and, to afford greater security, a driving key was also fitted.

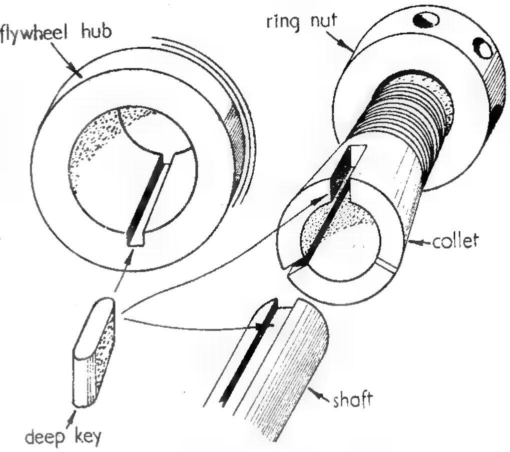


Fig. 13. *A collet mounting fitted with a feather key*

As will be seen in the drawing, this key seats in both the flywheel and the crankshaft; to allow of this, a slot is milled in the collet for the passage of the feather key.

This method of fitting gave a true-running flywheel, and, after many years of hard use, the parts are still in good condition and the flywheel shows no sign of wobble.

Model Engineering in the Middle East

(*Continued from page* 784)

that time, my knowledge of steam valves did not include any "gen" about links and slip eccentrics. The eccentric on this engine, however, is overhung and gives a movement of 5/32 in. to the slide-valve, which is built up.

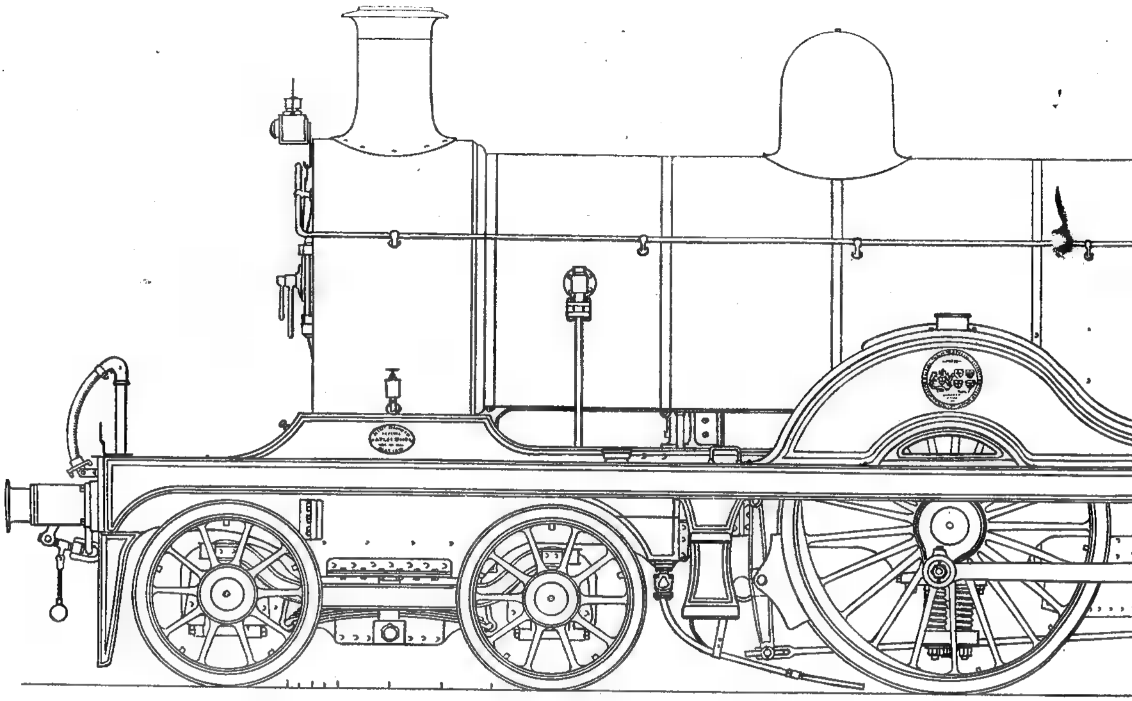
The cylinder also is fabricated. First a flat $\frac{1}{2}$ in. wide was carefully filed on the rough bored sleeve, and on to this face were soldered two plates of $\frac{1}{16}$-in. brass, which had been cut away to make steam and exhaust passageways. The ports are $\frac{1}{16}$ in. wide $\times$ $\frac{1}{4}$ in. long, and exhaust $\frac{1}{8}$ in. wide $\times$ $\frac{1}{4}$ in. long. They were drilled out and filed into rectangular slots. On completion of the soldering, the 6-B.A. stud holes for the top and bottom covers were drilled and tapped, and then the cylinder was finish bored (by hand again). The valve chest is of the "picture frame" variety, and the cover has a hole drilled and tapped in the centre for the steam inlet. The cylinder is supported from the baseplate by four $\frac{1}{4}$ in. diameter brass columns, which have 4-B.A. studs at the top, and are tapped 4 B.A. at the lower end. In this case I had to make the flywheel in two pieces, because of the metal difficulty. The rim is fitted round the boss, and a fillet of solder run into the corners. The piston has a single ring, of dural, though I think it would be just as effective had I left it plain with just the two or three oil grooves. The crosshead has a trunk guide $\frac{1}{2}$ in. bore, and is made from a bit of brass tube taken from an old stirrup pump. The guide block is pinned $\frac{1}{16}$ in. diameter to the piston-rod.

The total height of this engine is $4\frac{3}{4}$ in., and as to its performance, well, since my return home I have carried out several experiments, and find that running with a small load it will keep up a speed of 5,000 r.p.m. at 25 lb. pressure, and with very little vibration.

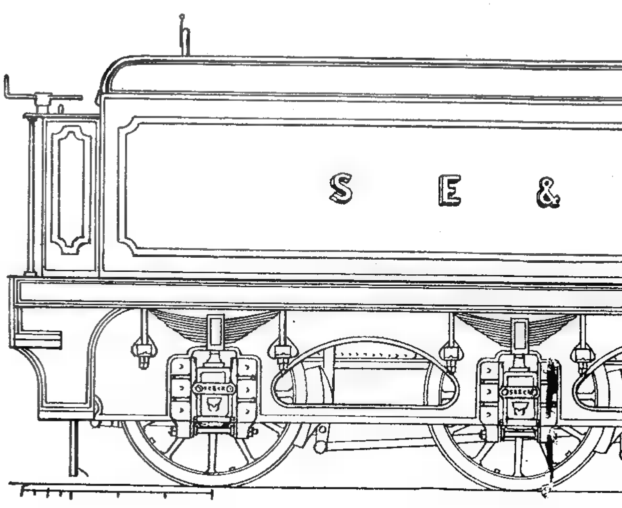
I would be pleased to hear from my old club chairman, Lt.-Col. R. Stopps, if he would communicate through the editor.

LOCOMOTIVES WORTH MODE

No. 33—South Eastern & C



Wainwright's " D " class for the S.E. & C. Rly. Never was an exhibition engine more resplendent



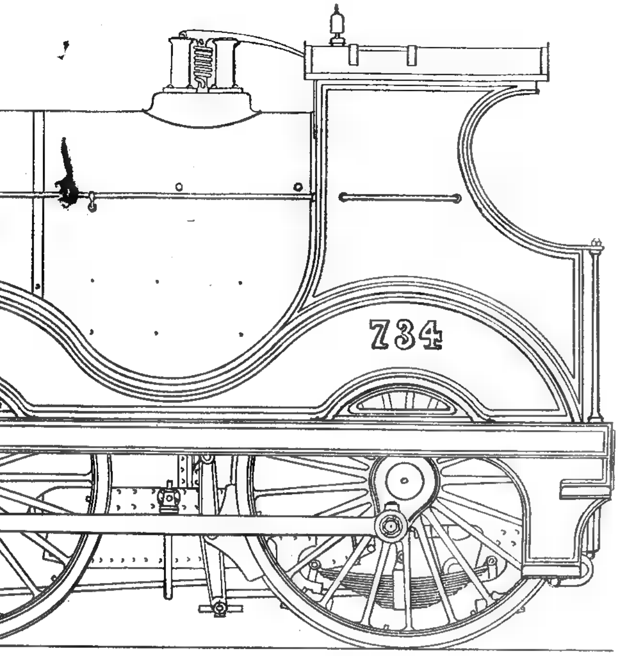
The tender of the " D " class was elaborately lined out i

IT is curious, when you come to think of it, how many associations the letter D has had with railway engines. True, you don't spell locomotive with a D, but just think of *Dunalastair, Duke of Connaught, Dreadnought, Dulwich,* or Derby, Doncaster and Darlington. Or again, Deeley, Drummond, Dean. So it is with this particular letter when used as a classification. All good locomodellers know of the famous L.N.W.R. " DX " goods engines, the lovable Stroudley " D " tanks; and that superb model that stands in Brighton's museum of *Como,* one of the " D2 " class and the forerunner of the great *Gladstone* herself. What a debt of gratitude we all owe to the late Dr. Winter for building that exquisite record of a Stroudley engine! Thanks to its presence in the museum we shall always be enabled to revive our memories of those glorious Brighton locomotives, and to gain inspiration and fresh encouragement from the superlative craftsmanship of the great master modelmaker.

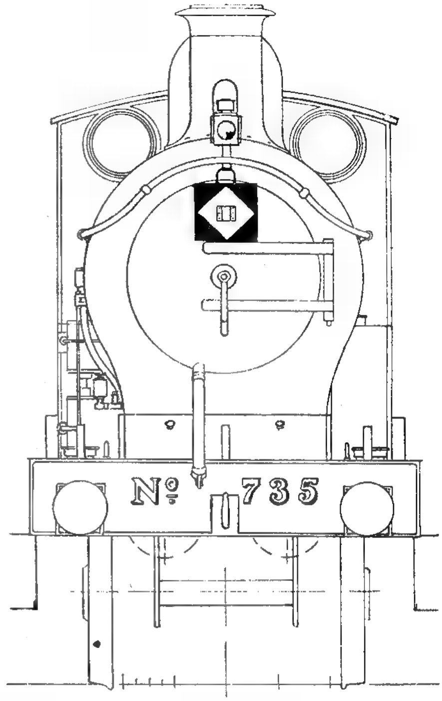
May we humbly try to follow in his footsteps, and leave other precious records of locomotives very worth while modelling.

ODELLING by F. C. Hambleton

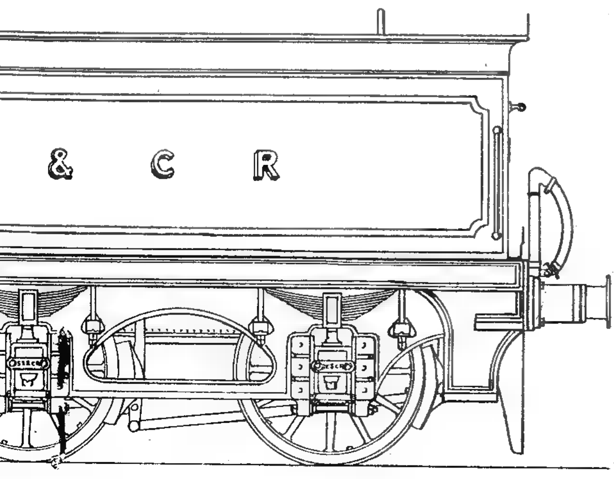
rn & Chatham Railway—No. 734



e resplendent in coloured bands than No. 734

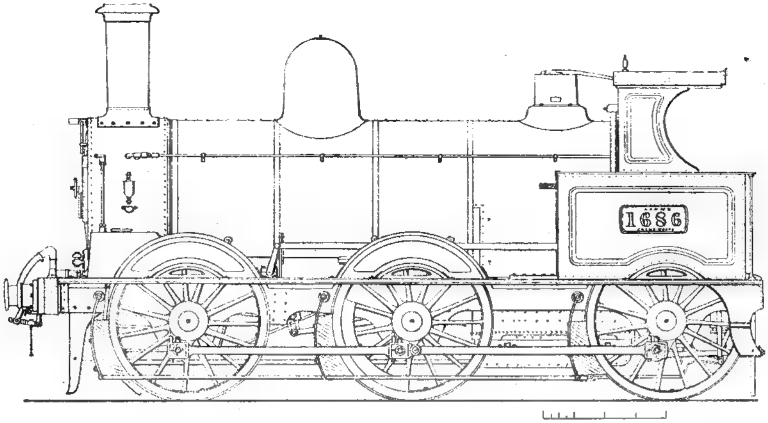


"Right away!" for Charing Cross to Dover express. Note the headboard hanging from lamp-iron hook

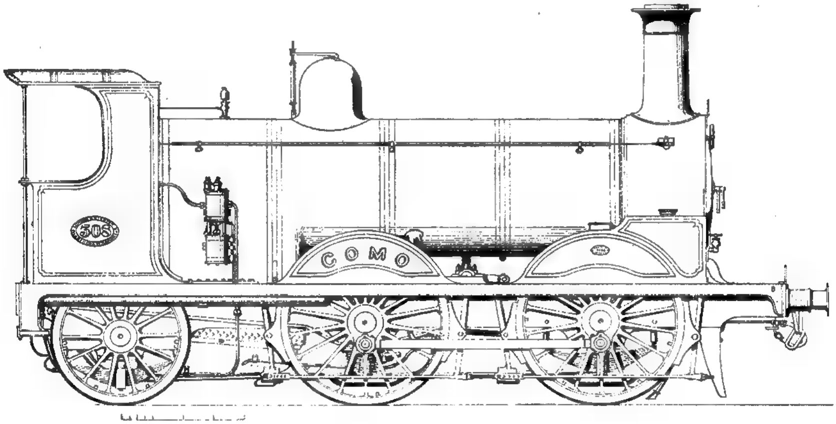


ly lined out in accordance with the Wainwright scheme

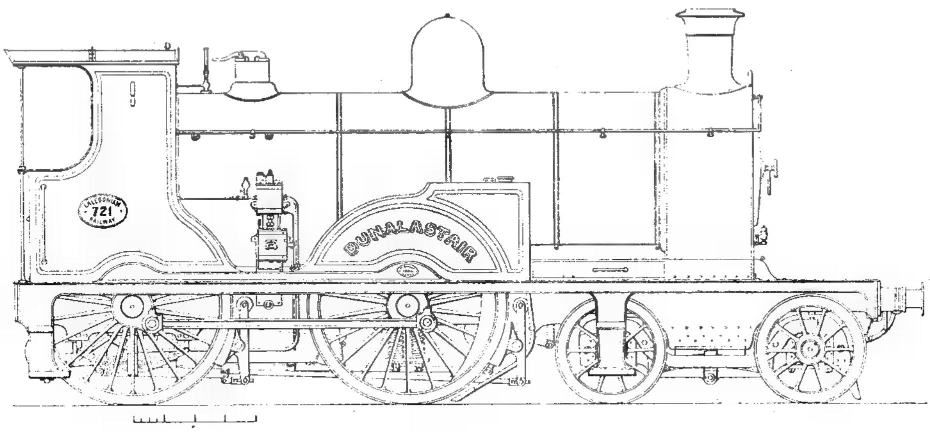
I can recall another "D" class engine, whose pleasing design, and gay colour-scheme caused a good deal of excitement on the old South Eastern & Chatham line. Wainwright's No. 734 certainly contributed her share of colour and polish when she stood, brand new, in the Glasgow Exhibition, of 1901. Of course, she was a native of the city, having been built by the famous Sharp Stewart & Co., at their Atlas works, but she was by no means the first example of the new livery promoted by the S.E. & C. Ry. managing committee. Already, the painters at Atlas works had adorned the new Wainwright side tanks as well as some new 0-6-0 goods engines, with the latest (and somewhat complicated) form of decoration. "What a change," they must have commented among themselves, "from the black engines we built, in the old days, both for Kirtley on the L.C.D. Ry., and Stirling on the S.E. Ry." True enough, yet if the colours chosen were quite novel for the two Kentish lines, now amalgamated under the title of S.E. & C. Ry., the design of the engine itself was only an interesting fusion of much that had gone before on the two old rival railways.



The " D.X." class of goods engines were very celebrated. 943 in all were built at Crewe Works !



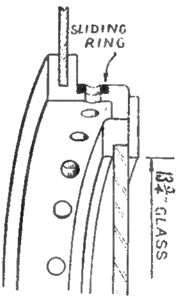
Stroudley's " D2 " class as originally built in 1883 at Brighton—what a beautiful little engine !



A very famous locomotive, the name of which began with the letter " D " !

In the main, one might say, No. 734 was an essentially Stirling engine. Such details as the steam reversing-gear, the motion, coupling-rods, the deep outside footplate angle and the cab, etc. etc., reminded one forcibly of the handsome "440" class—Stirling's last design. The outline of the polished brass dome cover, and the safety-valve with red painted spring and the red headlamps recalled Kirtley's fine "M" class (incidentally, also his last engines). There was a new touch in the chimney with its curiously narrow copper cap, and the continuous sweep of the brass band which edged the splashers had not been seen before—nor had the separate brass numerals. Another prominent feature was the polished brass window frames with their ventilating perforations, and the large transfer shields of the company, encircled by ■ riband, which decorated the driving wheel splashers (on the left was the S.E. Ry. shield, and on the right the four shields displayed by the L.C.D. Ry. as their device).

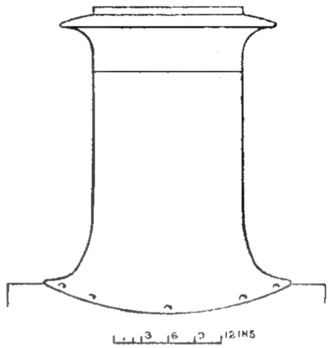
No. 734 was painted Brunswick green. The cab sheets and splashers had a fine border of black; next to this came a very fine red line which touched a light green band, on the inner edge of which was painted a fine yellow line. The lagging belts were also light green, edged with red and yellow lines. The mainframes by the smokebox projecting above the platform were Brunswick green edged with black and a fine red line separating the two colours. The ground of the polished maker's plate was red.



Section of the brass frame of the window, showing the ventilating holes

Wheel tyres black with red fine line, spokes green, hubs green with black band edging with fine red line on its inner side, axle ends black with fine red line on the edge. Outside angle framing, steps and guard-irons were light brown edged with black, a fine red line being placed between the two colours. Well inside all this again was ■ fine yellow line. The buffer sockets were also ornamented with the black, red, yellow line scheme, whilst the buffer beam was edged with black with ■ fine red line on its inner side. The tender coping was green edged with black and ■ fine red line, while the gilt lettering was shaded on the left with red and white, and ■ black cast shadow was on the right hand. Polished brasswork included: numerals, safety-valve manhole, dome cover, tubeplate cover, $1\frac{1}{2}$ in. rims round big splashers, and also surrounding the small coupling-rod splashers. What ■ colour-catalogue all this amounts to!

No one could deny that the "D" class added ■ great deal to the gaiety of the Kentish surroundings.



The chimney of the "D" class with its copper cap struck quite a new note on the S.E. &. C. Rly.

Indeed, these engines might well be described by our old friend Dudley Davenport as "Jolly D!"

Useful Dimensions
Cylinder, $19\frac{1}{4}$ by 26 in.
Cylinder centres, 2 ft. $4\frac{3}{4}$ in.
Wheels, 3 ft. 7 in. and 6 ft. 8 in.
Wheelbase: bogie, 6 ft. 3 in.
,, driving, 9 ft. 0 in.
,, Total, 22 ft. $11\frac{1}{2}$ in.
Overhangs, 2 ft. 4 in. and 4 ft. 0 in.
Rail to platform, 4 ft. $5\frac{1}{4}$ in.
Rail to boiler centre, 8 ft. 0 in.
Rail to chimney top, 13 ft. 4 in.
Height of chimney, 2 ft. $7\frac{3}{16}$ in.
Chimney internal diameter, 1 ft. 4 in.
Diameter of boiler clothing, 5 ft. $0\frac{1}{8}$ in.
Width of cab panel, 3 ft. 0 in.
Cab roof to floor, 7 ft. 5 in.
Length of smokebox, 3 ft. $0\frac{1}{2}$ in.
Length of barrel, 11 ft. 1 in.
Length of firebox, 6 ft. 6 in.
Length of connecting rods, 6 ft. 10 in.
Widths: platform, 7 ft. 9 in.
,, cab, 6 ft. 8 in.
,, small splashers, 3 in.
,, between frames, 4 ft. $1\frac{1}{2}$ in.

Tender
Wheels, diameter, 4 ft. 0 in.
Wheelbases, 6 ft. 6 in.
Overhangs, 4 ft. $2\frac{1}{2}$ in. and 4 ft. 0 in.
Top of coping, 4 ft. 9 in.
Width of tank, 7 ft. 2 in.
Width of coping, ■ ft. 0 in.
Between frames, 5 ft. $9\frac{1}{4}$ in.
Centres of bearings, 6 ft. 4 in.
Rail to buffers, 3 ft. $5\frac{1}{2}$ in.

Novices' Corner

The Test Indicator

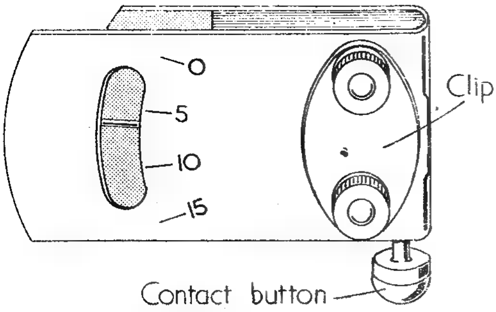


Fig. 1. *Back view of the Unique test indicator*

READERS of THE MODEL ENGINEER will have noticed how often the test indicator is referred to as a means either of setting work to run truly in the lathe chuck, or of aligning correctly parts mounted on the lathe saddle. In addition to these uses, the test indicator has other applications in connection with marking-out and testing work on the surface plate.

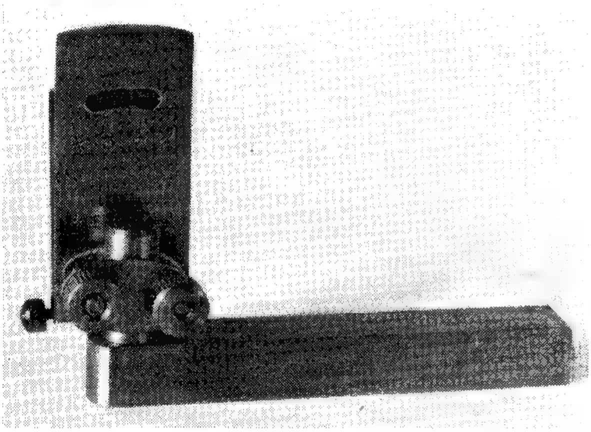


Fig. 2. *The toolpost holder for the Unique indicator*

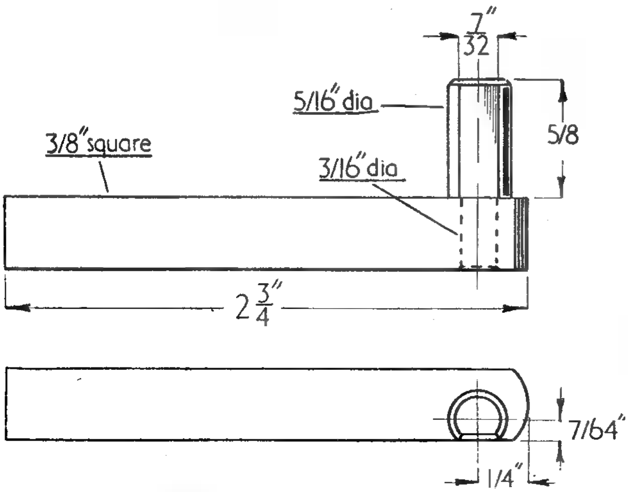


Fig. 3. *A toolpost holder for the Unique indicator*

The "Unique" Test Indicator

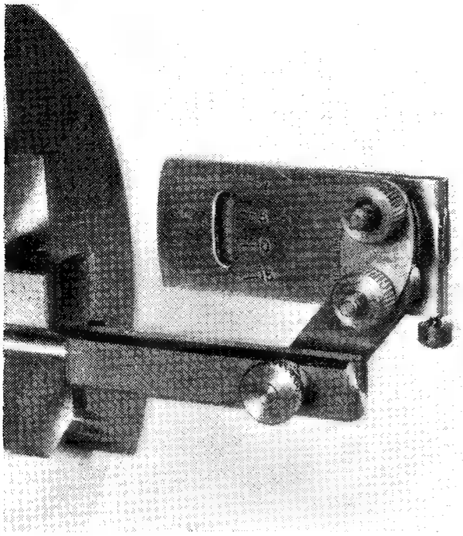
Although the dial test indicator is the most commonly used form of this instrument, there is a small device, the "Unique" test indicator, which is quite serviceable for all ordinary work and, moreover, it costs but a few shillings.

The general appearance of the Unique indicator is represented in Fig. 1, where it will be seen that a button projecting from the side is used to make contact with the work. As this button is pressed inwards, the indicator needle moves across a scale graduated in thousandths of an inch. The total range of movement is 15 thousandths of an inch. Two knurled finger nuts serve to close the clip that is fitted for attaching the device to a holder. As will be seen in the photograph, Fig. 6, the full scale is marked on the reverse side of the indicator, and that appearing in Fig. 1 is for the sake of convenience in working and represents only a portion of the full range of travel.

An additional fitting is also supplied to enable the indicator to make contact with internal surfaces when, for example, setting a bored hole to run truly.

Before going further, it will be as well to describe the usual methods of mounting the indicator so that it can be used either in the lathe or on the surface plate. When the indicator is employed solely for centring work gripped in the four-jaw lathe chuck, it can be conveniently mounted on a holder secured in the toolpost. A holder suitable for this purpose is shown in Fig. 2, and the working drawings for making the device are given in Fig. 3.

The square bar forming the shank of the holder should be of a length and thickness to suit the lathe toolpost. The pillar on which the indicator is mounted is made a force fit in the end of the bar and is pressed into place in the vice.



Above—Fig. 4. Test indicator mounted on a universal holder

Right—Fig. 5. A universal holder for the Unique indicator

A flat is filed on one side of the pillar to align the indicator with the shank when the knurled clamping-nuts are tightened. This mode of construction allows the indicator to slide on the pillar so that the contact button can be set on the centre-line of the work.

A Universal Holder

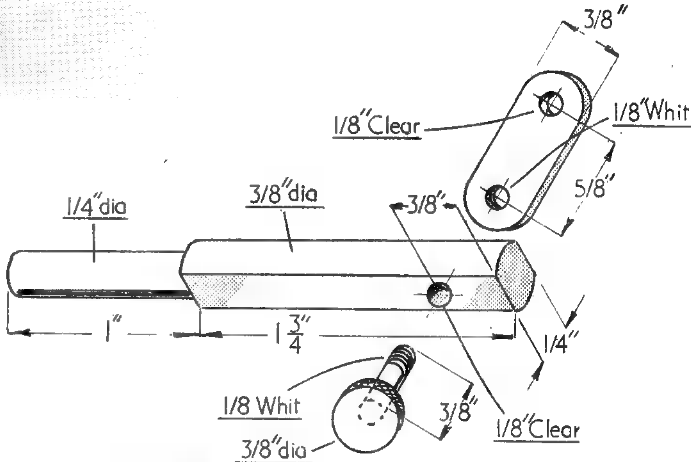
However, a universal type of holder will be required if full use is to be made of the indicator, by mounting it in the lathe chuck, as well as employing it for a variety of purposes on the surface plate. The photograph (Fig. 4) will make clear the general appearance of the holder, and the details of its construction are given in the working drawings in Fig. 5. The bar is made from a length of $\frac{3}{8}$ in. diameter round, mild-steel; one end is turned to exactly $\frac{1}{4}$ in. diameter for being gripped in the chuck and also to serve a purpose that will be described later.

The sides of the bar are filed flat to give a bearing for the link to which the indicator is clamped. The link is secured to the bar by means of a knurled clamping-screw, and the indicator itself is attached to the other end of the link with its own clamp. In addition, a $\frac{1}{8}$-in. clearing hole is drilled in the end of the bar to take either of the clamp-studs fitted to the body of the indicator.

When the indicator is mounted on the holder, the link allows the height of the button to be adjusted over a range of approximately 1 in. Should it be required to clamp the indicator with its button point forwards, as in Fig. 6, the link mechanism can again be used, or, as shown in the photograph, the indicator can be mounted directly on the end of the bar.

It will be seen in the photographs that a flat has been filed on both the upper and lower surfaces of the bar; this enables the holder to be gripped in the lathe toolpost when this manner of mounting is required.

As has already been mentioned, one end of the bar is turned to $\frac{1}{4}$ in. diameter; the purpose



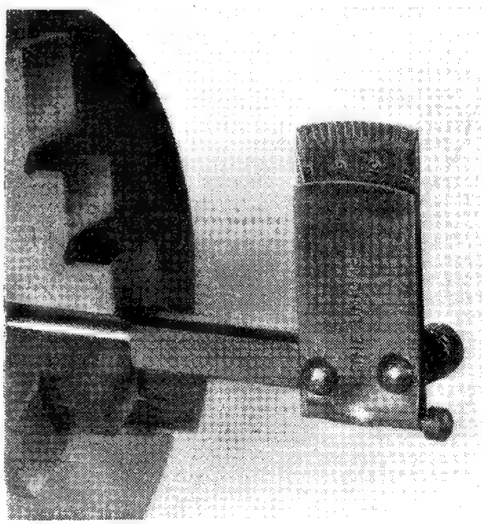


Fig. 6. The indicator mounted with the button pointing forwards

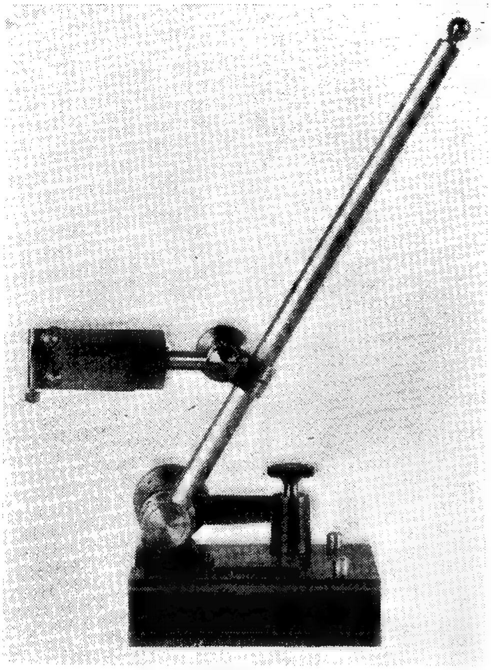


Fig. 7. The indicator mounted on the surface gauge

The indicator hand can readily be set to the zero position by turning the knurled bezel surrounding the dial. There are many ways of mounting the instrument in the lathe toolpost, but the easiest is, perhaps, to use the pillar clamp belonging to the surface gauge, and to attach this to a holder gripped in the lathe toolpost.

As shown in Fig. 8, this holder can be made from a length of round material which has its end turned to $\frac{5}{16}$ in. diameter to fit the standard pillar clamp of the surface gauge. When mounting the dial test indicator in the lathe chuck, as illustrated in Fig. 9, the clamp belonging to the surface gauge can again be used, and for this purpose the clamp is secured to ■ length of $\frac{5}{16}$ in. diameter rod gripped in the chuck.

In the photograph the indicator is shown fitted with its lever attachment that reverses the direction in which the instrument works; that is to say the indicator hand will move forwards when the outer spherical button is pressed downwards by being brought into contact, for example, with an overhanging shoulder.

For use on the surface gauge, the dial test indicator is mounted in the way shown in Fig. 7.

In a further article a description will be given of some of the more common uses of the test indicator in the small workshop, because it is an important instrument with the uses of which the novice should be familiar.

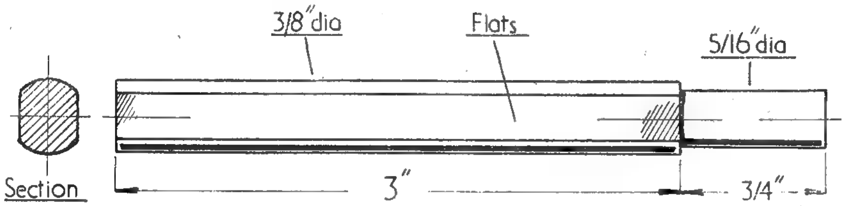


Fig. 8. Tool-post holder for a dial test indicator

of this is for mounting the indicator on the pillar of the surface gauge, as shown in Fig. 7. The Moore & Wright standard surface gauge is furnished with an adjustable sliding clamp for holding the scribing arm, but the clamp is also cross-drilled with a $\frac{1}{4}$ in. diameter hole for the purpose of mounting any standard pattern of dial test indicator. The advantage of mounting the indicator on a surface gauge of this type is that full use can be made of the coarse and fine adjusting mechanisms to set the indicator exactly ■ required.

The Dial Test Indicator

This is ■ precison instrument that records in thousandths of an inch over ■ range of some $\frac{1}{4}$ in.

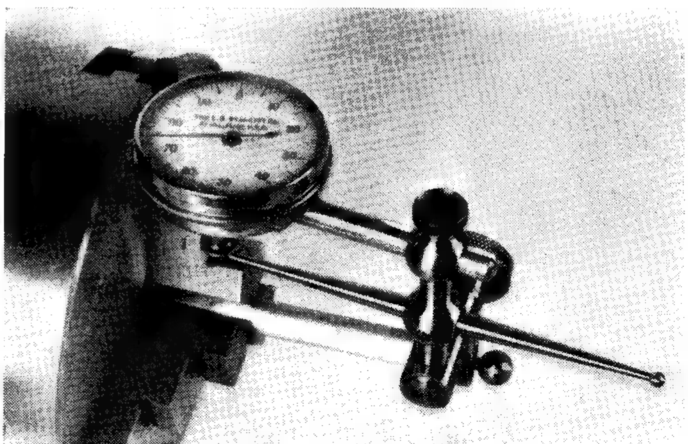


Fig. 9. The dial test indicator with the reverse attachment mounted in the lathe chuck

The Vancouver S.M.E.E.

AT the end of March, we received the following account of recent activities at Vancouver, B.C. Some considerable time has elapsed since we previously had any news of the local society of model engineers, and we are glad to learn that all is well over there. Mr. W. R. Johnson, the secretary, writes :—

"A word or two about your fellow enthusiasts in Canada might be interesting to your readers. Over here in Vancouver we have rounded out a very active year. Our club year climaxes with our participation in the Pacific National Exhibition where we packed a 75-ft. stall with very many interesting models, most of which were run under compressed air from a 2-h.p. compressor in a small room adjoining our exhibit.

Passenger-hauling at the Pacific National Exhibition. Frank Swinton trying out his unfinished "Hielan' Lassie" on the 150 ft. club track

"Mr. Herbert Rees formerly of Calgary displayed a fine Yarrow-type boiler fired by a 1,000-W electric unit. The feature of this model was the fore and aft glass observation panel in the boiler. The steady pop of the valve at 125 pounds intrigued the public.

"Our exhibit was really the major feature in the large Hobby Show building. Immediately beyond our stall and along the outside of the building was our 150-ft. track for the live steamers who worked on a daily passenger-hauling schedule. Over six thousand children from six to sixty were hauled up and down the straightaway. Mr. Jack Wood, formerly of the Winnipeg club, was much in evidence with his 1 in. scale Pacific American type coal-burner, completed just a few weeks before the Exhibition. This fine piece of work won the Chappel Trophy. Mr. Harry Dudley's 'Royal Scot,' also a 1-in. job, won second place, and Mr. D. G. Riches won third place with his beautiful ½-in scale L.M.S. Pacific. This engine was brought out from the old land recently.

"We missed very much our live steamer of last year, Jimmy Sarsons, who with his family left for Australia, taking with him his fine British type locomotive which was awarded the Chappel Trophy in 1948. We miss Jimmy very much and we join with his old pals of the Birmingham club in wishing him success and good steaming down under.

"Frank Swinton, one of our steadfast workers, but a man of few words, bolted down the boiler of "Hielan' Lassie' in the last few days of the show and hauled fourteen hundred passengers on the track in seven hours.

"A feature of our passenger-hauling this year was the safety device developed by Jack Wood, which prevents cars tipping when children lean over.

"Bob Kitson's ¾-in. scale Great Western four-cylinder job, unfinished, ran daily under air for the whole twelve days. Last year, this gained a special award for superlative workmanship. We are looking forward to seeing some good hauling done at the 1950 show.

"In the stationary engine group, Jack Wood won the Vancouver Machinery Depot Trophy for his twin marine. Mr. Harry Dudley came a close second, and Leo Vickman came third with his completely fabricated single vertical, a truly beautiful little job, but somewhat out of proportion. No lathe was used here except on the flywheel.

"About 100,000 people saw the show, a large number of whom were visiting Americans. It would take too many words to describe the host of models submitted. One in particular stirred a little sentiment ; Mr. Scott's model of Dunalastair. This gentleman's photograph as a railway apprentice in Scotland in 1882 was proudly tacked beneath the model, but we regret that the builder of this historic piece was not present. Mr. Scott lives on Lulu Island, but does not get around like he used to.

"It is somewhat to be regretted that more articles do not reach you from our friends in what used to be called 'the colonies,' but what we now like to refer to as the outposts of the

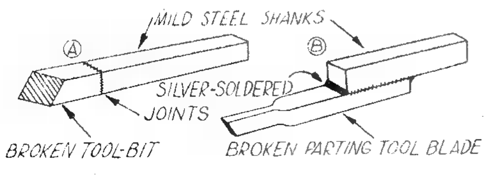
On the club track at Lulu Island, Bob Kitson driving Frank Swinton's "Austere Ada." Following is Jimmy Sarsons driving his British "Pacific"

Commonwealth. Our club was founded twenty-two years ago, and boasts a membership of about seventy-five, a large number of whom are active.

"Best wishes to all old country enthusiasts in model engineering—the hobby that keeps you young."

Using up short pieces of high-speed tool steel

MOST amateurs using high-speed tool steel bits of about $\frac{5}{16}$ in. square section will welcome a method of using up those short ends which accumulate after a short time. One



which the writer has found to be quite satisfactory in actual operation on a $3\frac{1}{2}$-in. centre lathe on annealed tool steels and austenitic stainless-steels is as follows :—

Grind the end of the tool-bit square and break the corners ; obtain a piece of mild-steel about 2 in. long of the same section as the tool-bit. These are silver-soldered together as shown in sketch (A).

It must be explained at this stage that high-speed steel, after the first hardening operation, that is, air or oil cooling from 1,250 deg. C., is then subjected to a tempering or "secondary hardening" operation by reheating to 600 deg. C.

Good grades of silver-solder melt at just over 600 deg. C. (Easyflo), therefore, if care is taken not to heat the work much above this temperature, the hardness of the tool-bit will not be appreciably affected.

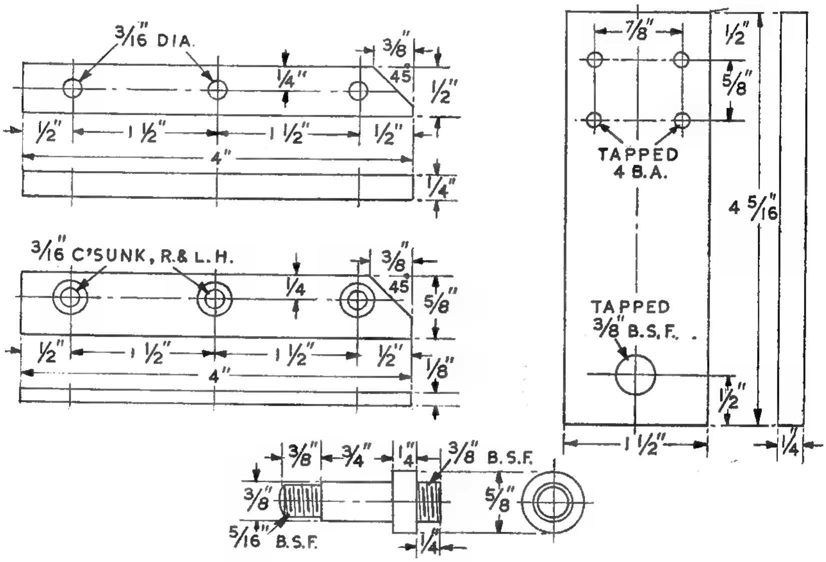
Another method of utilising broken parting-off tool-bits is illustrated in sketch (B).

It is necessary, of course, to grind the bottom surface of the finished tool reasonably flat.—F. E. KNAPP.

*A Sawing and Filing Attachment for the Lathe

by "Ned"

THE slide is made from a piece of mild-steel flat bar, 1½ in. by ¼ in., which should be as flat and true as possible to avoid the need for machining, but readers who have the facilities available may use material of slightly larger cross-section and plane or mill it to shape, a further refinement being to finish by surface grinding. After squaring up the ends, the flatness which affects nothing except the side from which the holes are countersunk, in the case of separate plates as shown. The two pairs of plates may be all clamped together for drilling the holes, and the countersinking should be deep enough to ensure that the screws, when fitted, do not project even to the slightest extent above the surface of the retaining plates.



Details of slide, check and retaining plates, and wrist pin

of the surfaces should be tested on the surface plate and any slight distortion corrected by scraping. The hole for the wrist pin is then drilled and tapped, and the screw holes for securing the saw frame spotted from the clearing holes in the latter, by clamping the parts together and using an alignment rod in the saw frame to check parallelism. Incidentally, the height of the cross slide varies in different types of lathes of the same nominal centre height, and this may possibly call for some alteration in the relative position of these two sets of holes ; the dimensions are for Myford M.L.4 and M.L.7 lathes.

The cheek plates and retaining plates should be dealt with in much the same manner as the slide, and the former should be exactly the same thickness as the slide. It is, of course, possible to plane or mill a rebate in strips of ⅜ in. material, instead of using two separate pieces of material for these components. Note that in either case the retaining plates are right- and left-handed,

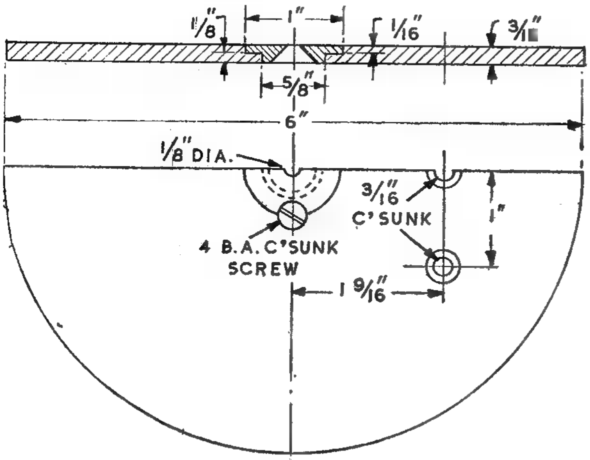
In order to locate the cheek plates on the face of the standard, the slide should first of all be clamped in its proper position, exactly central and vertical, and one cheek plate laid against it, and similarly clamped for spotting the tapping holes in the standard, after which the screws are fitted to hold it in place. The other cheek plate is then laid in position, the slide being released so that it can be moved to test for the existence of side play when the cheek plate is clamped, prior to spotting the holes.

After both cheek plates and retaining plates are fixed, the slide may be found to move very stiffly, and this may indicate that the cheek plates are not quite so thick as the slide, causing the retaining plates to bind. This can usually be cured by slight scraping or lapping-in of the slide, but if the difference is appreciable it may be found desirable to insert a paper shim under each of the cheek plates. Slight stiffness is to be preferred to slackness, as it will soon ease off when the slide is run in with plenty of lubrication. It is possible to provide for adjustment of side play by side elongation of the holes in one or

*Continued from page 717, " M.E.," May 18, 1950.

both cheek plates, but if these are located properly in the first place, it will be a long time before it becomes necessary to compensate for wear in this respect. Alternative materials for cheek and retaining plates are cast-iron, gunmetal or Tufnol.

The wrist pin is turned from mild-steel, the



Elevation and half plan of saw table

journal being finished to a good running fit in the small end of the connecting-rod, and highly polished. Cut the thread on the large end to a tight fit in the tapped hole in the slide; instead of turning the usual clearance groove in the pin, to enable it to screw right home against the shoulder, it is better to counterbore the first thread out of the hole in the plate. This avoids the weakening of the neck of the pin which is inevitable when a clearance groove is cut in it. The screwed end must not project beyond the back face of the slide, unless a relief groove is planed or milled in the face of the standard to avoid fouling.

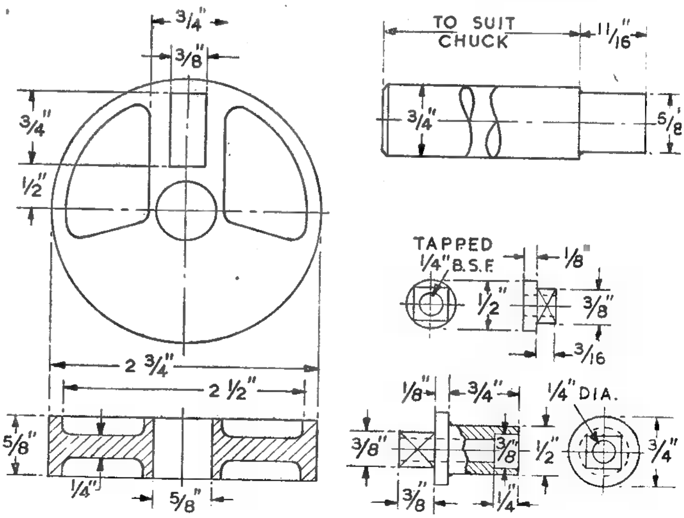
A stud-box may be used on the $\frac{5}{16}$ in. end of the pin to screw it in position. When the connecting-rod is assembled and the retaining nut and washer fitted, there should be just a slight amount of end play perceptible, but excess of play in any respect will tend to cause noisy working.

If the screwed pin is properly fitted in the manner described, it will never tend to work loose under normal conditions, but if any doubt is entertained about this, an alternative method of fitting is to slightly countersink the back of the slide and rivet the pin in, taking great care to ensure that it is really secure, and filing it down flush afterwards. This method, however, entails some risk of distorting the shank of the pin, and it is difficult to remove the latter if it should subsequently become desirable to do so.

Saw Table

The shape and dimensions of the table may be varied at the option of the constructor, but for most of the work likely to be handled by this device, a 6 in. table, either circular as shown, or square, will be large enough. A piece of $\frac{3}{16}$-in. mild-steel plate may be used for this, and should not require any machining on the surface. In the general arrangement drawing, the table was shown without a centre insert, and this will be quite satisfactory if it is to be used only to take tension files. But if it is intended to adapt it also to take saws, and machine files, it will be advisable to fit interchangeable inserts which allow the various types of tools to be used without excessive clearance which might affect the support of small pieces of work.

In this case the table should be bored and recessed in the centre as shown, and the inserts turned to fit, being held in place by two 4-B.A. countersunk screws intersecting the edge as shown. The first insert is easily fitted by clamping the table and insert together and drilling the screw holes on the intersection line, but for other inserts, the best way is to make a dummy plate or disc, recessed to match the table, in which the inserts may be temporarily clamped for this operation. It will, of course, be necessary to



Details of driving crank

drill into solid metal each time, but several inserts may be dealt with in one dummy by working in different places around the recess. When fitted, both the insert and screw-heads should be flush with the surface of the table

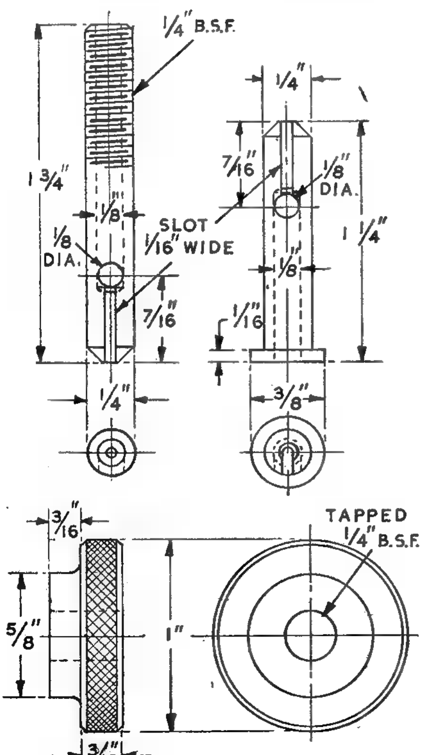
The position of the table relative to the swivel

bracket should be located after assembling the saw frame, and the use of a straight alignment rod $\frac{1}{8}$-in. diameter, with $\frac{1}{4}$-in. adaptors to fit the holes in the saw frame, will be helpful in this respect. Using a tension file in working position may not be sufficiently accurate, as the files are not always dead straight, even under tension, or correctly centred by their headed ends.

Driving Crank Details

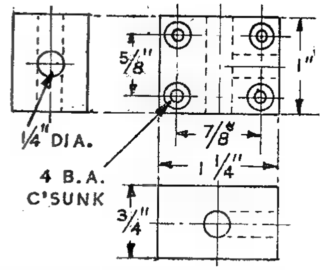
The cast crank disc should first be chucked for rough facing on one side and turning as much of the outside as possible, then reversed and similarly dealt with on the other side, also bored through the centre and slightly countersunk each side. Subject to any modification in the method of mounting the driving crank, the journal should be turned as shown, preferably between centres, the reduced end being made about 0.001 in. larger than the hole in the disc. If both the surfaces are smooth and accurate, this will produce a tight interference fit, and no advantage is gained by trying to fit it any tighter; it will be possible to press the journal in by using the bench vice, a short bush or washer being interposed behind the disc to allow the end of the journal to project when fully pressed home. This end is then firmly riveted down into the countersink of the disc.

If properly carried out, this method of fitting will be adequately secure for taking all working torque, but if further security is deemed necessary,



Tension file adaptors and tension nut

Holder for machine files



a hole may be drilled endwise into the intersection of disc and pin, on the side opposite to the crankpin, and a dowel pin fitted. The journal is now replaced between centres, and the front side and edge of the disc turned to finished size, at the same time facing the end of the pin flush with the disc. If the slot is cast in the disc, it will probably require a little filing to clean it up, but if it has to be cut from the solid, this may be done by drilling and filing, or by end milling, and subsequent filing at the corners.

Both the crankpin and the nut have squared spigots to fit in the slot of the crank disc; these may be either milled or filed, a very useful tool for facilitating this operation being the filing rest which was described some years ago in THE MODEL ENGINEER, and is also illustrated in the MODEL ENGINEER handbook, *Lathe Accessories*. The crankpin journal is turned to a smooth working fit in the large end of the connecting-rod, and the centre drilled and counterbored to take a $\frac{1}{4}$-in. B.S.F. socket-head Allen screw, the end of which engages the tapped hole in the squared nut. Both the crankpin and the wrist pin may be case-hardened with advantage on their working surfaces, but it is not desirable to harden the threaded parts, which should therefore be protected by screwing nuts on to them, the threads being lubricated with graphite to ensure against seizure.

Tension File Adaptors

The upper and lower adaptors differ in detail; the former being screwed to take a tension nut, and the latter having a rim to fit the counterbore in the underside of the saw frame and take the thrust. In other respects they are the same, both having a $\frac{1}{8}$ in. hole drilled from the outer end to within $\frac{3}{8}$ in. of the other end, the remainder being drilled $\frac{1}{16}$ in. diameter. To enable the tension files to be inserted, a slot is cut in the side of the adaptor, terminating in a clearance hole large enough to take the head of the file. This is not quite the same as shown in the general arrangement, where the adaptor was cross-slotted to form the clearance. It has, however, been found that it is easier and just as effective to drill a $\frac{1}{8}$ in. hole diametrically in one side, and this entails less weakening of the adaptor than the cross slot.

The longitudinal slot in the adaptor can easily be milled in the lathe, using a $\frac{1}{16}$ in. Woodruff type cutter in the chuck, and holding the adaptor in the tool post at a suitable height to enable the cutter just to reach the centre hole. A small vee packing block, made by milling, planing or

filing a groove in a piece of $\frac{3}{8}$ in. square mild-steel bar, is useful for holding work of this nature. It is advisable to drill the cross clearance hole first, and run the cutter into it, or probably slightly beyond, in order to ensure that the slot is cleared properly, allowing for the run-out of the cutter. Apart from appearance, a slight over-run of the cutter does no harm. The clearance bore of the adaptor should run slightly past the cross hole to ensure that the head of the tension file is properly centred. With this form of adaptor, exact location of the file is facilitated, and the file can be fitted or removed very quickly, an advantage when dealing with work having " blind " apertures.

The tension nut calls for no comment, being simply a steel or light alloy knurled nut of adequate size for easy handling ; alternatively, a wing nut could be used, but it should be noted that excessive tension on the file is neither necessary nor desirable, and a knurled nut 1 in. diameter will enable quite enough force to be applied by hand.

For fitting 6 in. coping saws to the frame, adaptors may be used having the ends slotted by means of a circular saw in the lathe, and fitted with cross pins. While it is desirable to provide some means of keying the saw blade to prevent rotation, this is not absolutely necessary, so long as care is taken to see that the blade is not twisted as it is tightened up in the frame. For positive alignment, however, a snug key may be fitted to the lower adaptor, to engage a notch in the underside of the frame, and a small key or pin fitted to the upper adaptor, to engage an internal keyway in the bore of the frame.

File Holder and Adaptors

Files intended for use in filing machines have various methods of fitting, but the type most suitable for use in this attachment is that having a $\frac{1}{4}$-in. round shank. This can be fitted in a steel or light alloy block, which is substituted for the saw frame, and attached to the slide in the same manner. A $\frac{1}{4}$-in. Allen screw in the side of the block will hold the file securely. The hole for this screw is shown on the drawing as $\frac{1}{4}$-in. dia., but should obviously be tapped $\frac{1}{4}$ in. to suit the screw fitted.

In fitting a holder of this type, the same care should be taken to ensure that the tool is held in true alignment with the plane of the stroke as in the case of the saw frame. The block should first be machined accurately on its bolting face and the hole for the file bored parallel with this face. It should then be clamped to the face of the slide, using an alignment rod in the hole to check its parallelism with the sides of the slide, and the clearance holes spotted through the tapping holes from the back of the slide.

It is often an advantage to use small needle files in a filing machine, and this may be done by fitting the files to $\frac{1}{4}$-in. round adaptors. Note that these should be fitted on the point end of the file in order to cut on the downstroke, and the tang end of the file may then be broken off and discarded.

To secure a file of this type to the adaptor, the latter should be drilled with a hole large enough to take the file point ; this hole is then internally tinned and filled with soft solder. The end of the file is then cleaned and fluxed, the adaptor is heated to melt the solder, and the file plunged in. This method is also suitable for holding the larger diameter soft-core files now being made by the makers of Abrafiles, and also for sabre saws, which are useful in many kinds of woodwork. These saws are the equivalent of the hand keyhole saw, being rigid enough to avoid the necessity for fitting to a tension frame, and are, of course, the handiest type for " blind " aperture or piercing work. Short lengths of jigsaw blade, as used in full-size woodworking machines, can be adapted as sabre saws in this way ; don't forget to mount them with the teeth pointing downwards.

When using saws, the table insert should have an elongated slot instead of a circular clearance hole ; hardwood or bakelite inserts are better than metal when using woodworking saws.

In view of the wide range of utility of a simple attachment of this kind, and the facility with which it can be brought into action when required, its usefulness in saving time and labour in practically any branch of model engineering work is beyond question, and the comparatively small amount of work involved in its construction will be found well worth while.

Small Locomotive Fittings

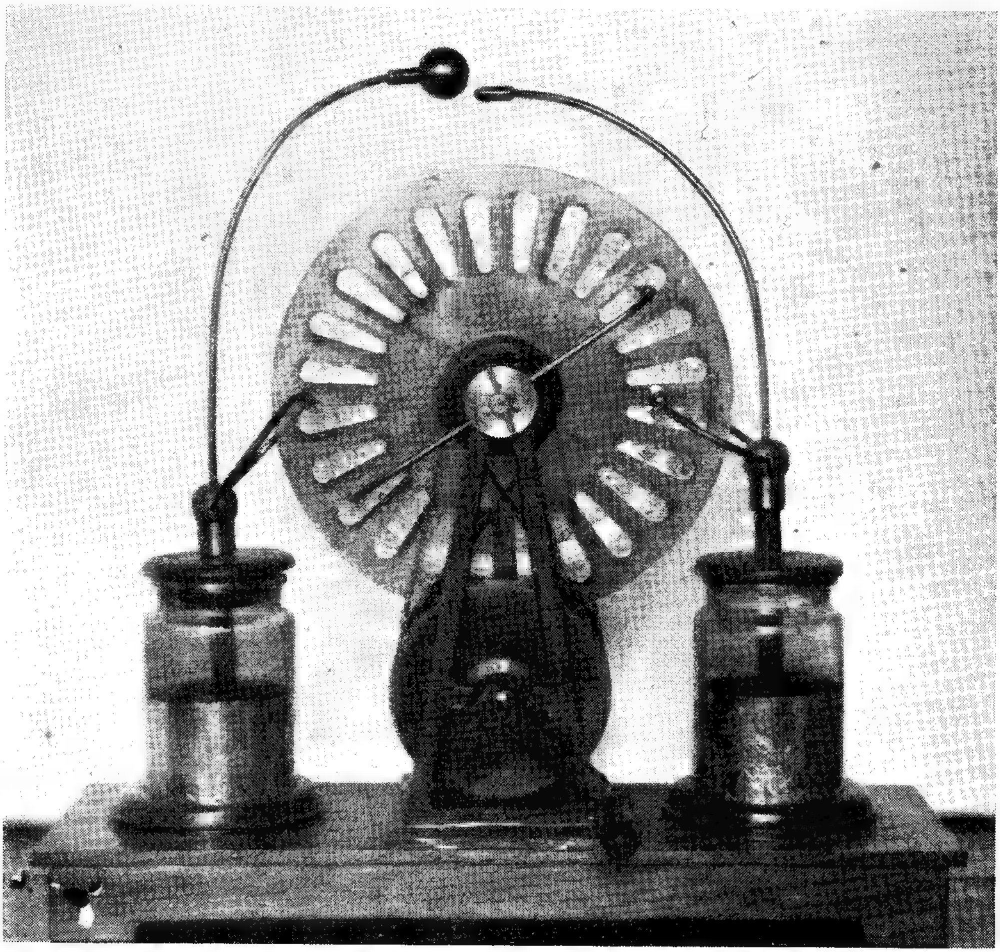
FROM BONDS O' EUSTON ROAD LTD., we have received samples of two new steam fittings which we think should be of interest to those of our readers who build or use model boilers. One is a locomotive water-gauge, the blow-off tap of which is in line with the glass ; this feature not only imparts a neater appearance to the gauge but it is a decided aid to easy fitting-up on the backhead. The liner of the pipe connection is fitted with a ball-type ferrule, which is a novel and important departure from the more usual cone. The tap is provided with a neat and easily-accessible handle, while the adjustable nuts which are provided for the top and bottom parts of the gauge provide an easy means for lining up the whole fitting without risk of damage to the glass.

The second fitting is a double pipe union cock in which an easy-cleaning type of plug and the provision of ball-ends to the ferrules are the principal features. The fitting is available in three different sizes to suit, respectively, $\frac{1}{8}$ in., 5/32 in. and $\frac{3}{16}$ in. pipes. It is a neat and well-finished article that should find many uses.

A WIMSHURST MACHINE

by H. E. Rendall

In the days when The Model Engineer was young, examples of the Wimshurst machine for generating frictional electricity made fairly frequent appearances in its pages, and ready, as after the Wimshurst's repertoire of experiments has been exhausted, there is a tendency to relegate it to an out of the way dusty corner.



but latterly they seem to have faded out, and I can hardly remember one during the last twenty years. Many readers probably have never seen one of these machines in action, which is a pity, because they always arouse interest, even among the non-technical. They can be built in a fairly rough and ready way, but those who like to display their craftsmanship can make a very showy machine. Personally, I recommend the rough

The machine illustrated is one that I built for a boy of twelve, with scientific interests, and has been the subject of various experiments. It has 10 in. plates and a usual spark length of 1½ in., but on one, and only one, memorable summer afternoon it was giving 2½ in. sparks without effort.

Quoting from an old number of The Model Engineer and Electrician as it was then,

100,000 volts are needed for each 1 in. of spark length. As the theory of the Wimshurst is given in any book on physics, it is hardly worth repeating it here; suffice to say that the machine consists essentially of two parts: (1) the generating system and (2) the collecting system. The generating system consists of two plates, revolving in opposite directions and two neutralising rods, one each side of the machine at right-angles to one another and bearing little brushes of tinsel, which gently touch the sectors on the plate. Latterly I have been unable to get tinsel, so have used a sort of metallised paper, sold for Christmas tree decorations. I found in a shop two ebonite plates, already provided with sectors and I fitted them, but unfortunately the ebonite was perished and I do not think that there is any cure for ebonite in that condition. At any rate the machine would not generate without being excited.

To excite a sulky Wimshurst, I roll up brown paper into a sort of wad, thoroughly dry it over a gas ring and pull it smartly under my arm. If

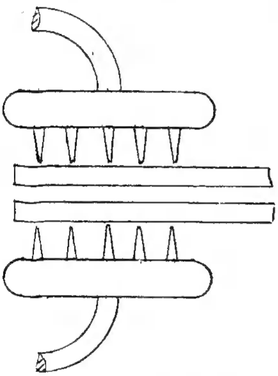


Fig. 1

the paper is really dry it will soon show signs of electricity, and held near one of the plates, when the machine is running, there will soon be that hissing and smell of ozone, which announces that the machine has come to life. However, we soon got tired of the ebonite plates and I fitted glass plates, varnished with shellac and provided with 24 tinfoil sectors. I filed up a pattern out of $\frac{1}{16}$-in. sheet steel, and cut out all the sectors round this and also prepared a paper diagram, showing the positions of sectors. By laying the glass disc on this pattern, it was an easy job to fix the sectors in position with shellac varnish.

A large number of sectors is supposed to give easy starting and a lesser number of sectors a longer spark length, but I tried various numbers without any appreciable difference in the result. The machine always generated copiously, but the Leyden jars are only jam jars of poor quality glass, and however much electricity is generated by the machine it leaks away and I can never get as long a spark as I should. Tinfoil is gradually rubbed away by the neutralising brushes and leaves metallic streaks between the sectors, so that leakage sets in and the spark length falls off. It has been suggested that sectors of thin brass foil will overcome this difficulty, but I am told that they are difficult to attach securely.

Well, we got tired of these antics too, so I removed the sectored plates and fitted plain unvarnished discs instead, the machine in this condition being known as a Bonetti. The neutralising brushes had to be changed for ones covering

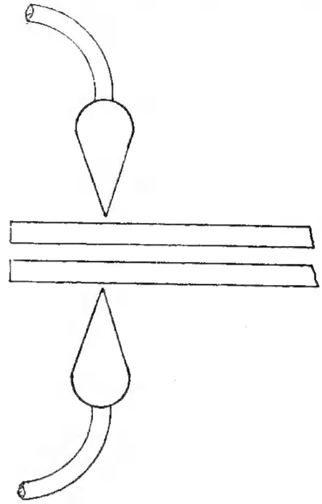


Fig. 2

about one quarter of the plate diameter, and the collecting brushes, about which more later, also had to be changed. The machine as a Bonetti was not self-exciting and, although it generated just as copiously as a Wimshurst, was so inconvenient in use that we replaced the sectored plates.

Gramophone records are sometimes recommended for Wimshurst discs. No doubt each maker has his own pet composition, but the only gramophone disc Wimshurst I ever saw had nothing of the life or strong excitation that I have got out of the ebonite and glass plates.

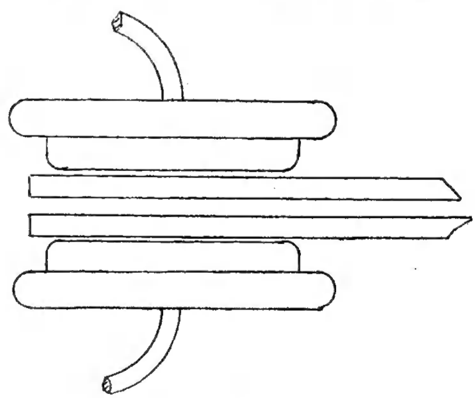


Fig. 3

The discs in my machine are attached to hardwood bosses, bushed with brass, using a good proprietary adhesive and a piece of flannel in between. This is about all that need be said about the generating portion of the machine,

though I might mention that I once saw a scientific toy, consisting solely of the generating portion of a Wimshurst, but with rather longer sectors. Run in a dark room it was a very pretty sight with its violet coloured brush discharges and it would light a vacuum tube held in the hand or streams of electricity would pass into one's fingers, if held near enough.

There is not much to be said about the collecting system, except that any rough surfaces or angular outlines will be sources of leakage and, therefore, must be avoided. The first collector I made was in the form of a comb, like Fig. 1. I replaced this by a single point collector, Fig. 2, which seems just as efficient, but for collecting from a Bonetti system the collectors must be of the same width as the neutralising brushes. I made mine out of brass tube with a slip of brass inserted, as shown in Fig. 3. The collectors each side discharge into brass balls on top of the Leyden jars, thence the electricity passes to the two sparking points or balls, which can be swung apart to vary the gap. The Leyden jars are coated inside and outside with tinfoil, but as I mentioned before, they are the weak points in the machine.

I suppose I might confess that when I made this machine my knowledge of frictional electricity had got very rusty, which led to an unfortunate incident on its first trial. We had been generating streams of little sparks and I suggested to the boy that we might try the effect of the Leyden jars and told him to hold the outer coatings. Almost immediately there was a vicious 1 in. spark at the points and a piercing yell from the boy. This little incident took a bit of explaining away but we did learn to use brass chain in future for joining the outer coatings.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by stamped, addressed envelope, and addressed: "Queries Dept." THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered within the scope of this service.

No. 9803.—Rectifying A.C. Current to Run D.C. Motor
H.W. (Mill Hill)

Q.—I would like to ask your opinion of rectifying 230/250 volts a.c. to run a single-phase 230/250, ¼ h.p., d.c. motor. Could you please give me the necessary details of such a rectifier, and would any additional equipment in the form of a condenser be required? Finally, I should like to know what the overall efficiency would be as compared with a similar a.c. motor.

R.—You state that you wish to rectify the a.c. mains current to run a *single-phase* 230/250, ¼ h.p., d.c. motor. The term "single-phase" cannot apply to a d.c. motor, and we wonder whether a mistake has been made, and some other descriptive term should have been used. We are extremely doubtful whether the use of a rectifier for such a purpose would be efficient or economical. It would be necessary to supply a greater input voltage to the rectifier in order to obtain the full voltage for driving the motor, the increase necessary being usually about 10 per cent., and this would necessitate the use of a transformer to step up the voltage before rectifying.

In order to take care of any possible surge of current at starting the motor, we suggest that the rectifier would have to have a capacity of at least 500 watts, so that both the rectifier and transformer would have to be fairly large. We do not think that it is practicable to construct a rectifier of this type successfully, or at least with any saving of cost over a ready-made rectifier.

No condenser should be necessary unless the provision of some form of smoothing unit should be found desirable for such purposes as avoiding radio interference. In view of the transformer, rectifier and motor losses, we do not think the overall efficiency would compare with that of an a.c. motor run direct off the mains, though we are unable to give you any definite advice on this point. Altogether, we consider that it would be less costly and more efficient to dispense with the d.c. motor and obtain an a.c. motor.

No. 9806.—Reversing Turbo-engine
T.R. (Swansea)

Q.—Having read an article on the propelling machinery of a motor trawler driven by an eight-cylinder Mirrless direct reversing turbo charged engine operating through a Bibby detuning coupling, I would be glad if you could explain what is meant by a "detuning coupling."

The article states that in steam turbines, the rotor cannot be in perfect dynamic balance, as the centre of gravity does not coincide with the geometric axis. I thought that the centre of gravity always passed through the geometric axis, and have been unable to find any definition in back issues of THE MODEL ENGINEER.

R.—We are not familiar with the term detuning coupling, but the form of coupling which is usually associated with the name "Bibby" is a shock-absorbing coupling capable of accommodating a certain amount of misalignment, though it is not a true universal joint, and it is possible that this is referred to as a detuning coupling because it helps to damp out torque vibration. We are unable to understand the statement that the rotor of a steam turbine *cannot* be in perfect dynamic balance, as it is invariably necessary to obtain the highest possible degree of dynamic balance for the turbine to be successful at all. It is possible that what is meant is that it need not *necessarily* be in dynamic balance, although static balance is correct. The theory of dynamic balancing is too complex to expound here, but it has been dealt with in several text books on the steam turbine.

No. 9809.—Coil-winding on the Lathe J.R. (Bolton)

Q.—I am desirous of building a coil-winder capable of covering general wireless work, i.e. small i.f. coils to mains-transformer winding (also electric motor-driven and fully automatic if possible). Can you help me with a drawing or design data?

R.—We have published articles in the past, dealing with the construction of coil-winding machines, but we have none of the issues in stock in which such a description appears.

It is a comparatively simple matter to convert a small lathe to serve as a winding machine, by adding some form of automatic feed, capable of working in both directions, but a fully automatic machine would presumably incorporate also an interleaving attachment, which would be a much more difficult thing to construct.

We are sorry we have no drawing available, and the task of preparing a complete drawing of such a machine would be rather outside the scope of our queries service.

No. 9810.—Blue Glass Goggles A.L. (Port Talbot)

Q.—In your book, *Welding and Flame Cutting*, the authors state on page 20, "Never use 'blue glass' goggles." All the works here only issue blue goggles. Will you let me know the reason, as with bad eyesight, I cannot take any more chances. I may add that I use them for brazing only.

R.—The temperatures attained by the metal when brazing by the ordinary methods are very much lower than those encountered when welding, and the intensity of the light emitted by either the blowpipe or the heated metal is also much less. In that case, blue glass goggles would be quite satisfactory, but they are quite incapable of filtering out the injurious ultra-violet rays generated in either arc or oxy-acetylene welding.

No. 9811.—Wire for an Electro-magnet D.S.P. (Bath)

Q.—I shall be grateful if you can give me some advice on the wire to use to wind an electro-magnet to the following :—

Outside diameter of winding, 1 in.; M.S. core pin, $\frac{3}{16}$ in. diameter; Length of winding, 1 in.; Voltage, 6; Amperage, 1 to 2.

With use, as in a bell buzzer, the temperature rise not to exceed about 100 deg. C. during prolonged operation. It is important to get the maximum possible pull. I propose using enamelled copper wire, and shall be glad of any tips and advice.

R.—It is very difficult to calculate the efficiency of an electro-magnet from first principles. Basically, the amount of pull obtainable from any given electro-magnet depends upon the number of ampere-turns, or in other words, the current in amperes multiplied by the number of turns on the magnet coil or coils. In actual practice, however, the calculation is not as simple as this, because the flux efficiency will depend to some extent upon the distance of the conductors from the core, and the outer turns of a magnet coil are often of low efficiency, or even a negative efficiency in relation to their resistance. We are of the opinion that if you fill the available space in your magnet coil with No. 24 gauge enamel covered copper wire, you will find that it will take something between 1 and 2 amperes at 6 volts, and provide a very efficient pull, but we do not claim that this is necessarily the best efficiency that can be obtained from the particular wattage input, and you may find it desirable to make some experiment with either larger or smaller gauges of wire wound into the same space.

No. 9812.—Paraffin and Petrol Engines A.J.H. (Wellington)

Q.—Would you please tell me the outstanding differences between a paraffin engine and a petrol engine. Apart from the wind, paraffin is my only available fuel, and as I only want about 1/6 h.p., I thought I might use a petrol motor, well cooled and silenced with the form of carburation you may suggest. The latter is, I presume, the main difficulty. I have no difficulty with the wind, only that it is the personification of *X* and a quiet engine using only a percentage of power (with petrol and fully tuned up) would be a useful standby.

R.—There is no essential difference in the design of the two types, except that it is usual to provide some means of heating the mixture in the case of a paraffin engine in order to assist vaporisation. The heating device usually consists of a hot-spot manifold or some similar means of using the exhaust heat to warm the incoming mixture. As engines running on paraffin are generally more prone to knocking than petrol engines, it is often found necessary to reduce the compression ratio.

A great disadvantage of using paraffin in a small high-speed engine is that combustion is generally somewhat imperfect and the fuel eventually works past the piston rings and destroys the efficiency of lubrication. The wear of piston cylinders and bearings is usually very heavy in small engines run on paraffin fuel. The design of the carburettor is not necessarily different for paraffin, but more exact adjustment is generally found necessary.

PRACTICAL LETTERS

Model Submarine

DEAR SIR,—I was very interested in the query and reply on the above subject. Before the war I made at least half-a-dozen model submarines, and all were fitted with horizontal hydrofoils as in full-size practice. All were elastic-driven and quite successful.

Perhaps " A.F.W. " would like to hear of the method I used.

First of all, sufficient ballast in the shape of a lead or iron keel was fitted so that the model floated with decks almost awash. In other words the model was left with very little buoyancy to be destroyed. Horizontal hydrofoils were fitted fore and aft, as well as the usual rudder. A negative incidence of about 2 deg. on the forward hydrofoils gave good results.

As soon as the model started its run, the forward motion produced a downward pressure on the hydrofoils and the submarine would submerge after a run of a few feet.

The models would submerge to a depth where *the increased upward pressure on the hull equalled the downward pressure due to motion* and would then travel *constantly at that depth* (generally 1 to 2 ft.) until the motor stopped, and then slowly rise to the surface.

The angle of the hydrofoils controlled the running depth. The automatic surfacing when the motor stops has its advantages, especially if there are lots of weeds about. Surface runs were obtained by setting the hydrofoils horizontally, that is, no negative incidence.

Only comparatively short runs were made, of course, with elastic drive (about 50 yards). With an electric motor for power I would suggest a worm and gear-driven cocking device for the forward hydrofoils, so that the vessel periodically submerges and surfaces.

The after hydrofoils I found could be set with a very slight *positive* incidence and then be left in that position.

This system of operation entirely depends on the fact that the model is ballasted so that the reserve of buoyancy is very small. If " A.F.W." likes to contact me through the Editor, I shall be pleased to " compare notes."

Yours faithfully,

Hitchin. G. A. WALTER.

DEAR SIR,—I suggest that the reply to " A.F.W." in the April 13th issue, is rather misleading and partly incorrect :—

1. If the bouyancy of the vessel is ever destroyed, this would give it negative bouyancy, which would be unsafe and possibly fatal, according to amount of destruction.

The submarine is trimmed to diving stability giving it positive bouyancy so that in the event of a mishap to the diving apparatus the motors are stopped and the vessel will automatically surface, otherwise with destroyed (or negative) bouyancy, the vessel will sink, and emergency pumping of tanks will give the vessel uneven trim.

2. I suggest that hydrofoils is a misprint, and should read hydroplanes as applied to underwater craft.

3. For submerging operations, a scheme of cam movement could be designed, working off the propeller shaft and giving the forward and after planes sufficient angle to keep the submarine at periscope depth. The angle of incident being controlled by the cam in unison with the positive bouyancy, and the after plane to take her down, the function of the fore plane is to keep her on an even keel. These angles could be found by trial and error, using a light angle at first so as to provide data for further experiment before arriving at the cam design.

The cam is designed so as to be able to submerge and surface during its voyage across the lake.

In actual practice both planes take her down to depth, then the forward plane working in unison with after plane retain an even keel at the set depth.

These models have the same running conditions as the model sailing yachts, in that once they have left the dockside they have no man aboard to make further adjustments, so that such adjustments must be made at the dockside for a safe return.

May I suggest to " A.F.W.," as he lives in the London area, to make a visit to the Maritime Museum Greenwich, where he will see some fine specimens of submarine. He may also be able to get some good advice from the curator.

Hoping that this may be of some help to him.

Yours faithfully,

Southsea. F. E. WRIGHT.

The Goyen Lathe

DEAR SIR,—The detail and photographs published in the March 23rd issue, seem to have been of interest to numerous readers, as may be gathered from letters appearing in the April 27th issue. .

Goyen did all his own work, and so made only a few lathes together with apparatus, constructed at his home, a house named the " Chalet Bon Air," which, if my memory is correct, is situated on the main road between Newton Abbot and Kingskerswell. The last time I was in that district, two of his daughters still resided in the locality.

Goyen workmanship is superb. Some turners claim it is not surpassed by makers of ornamental, rose engine, medallion, geometric equipment such as Birch, Holtzapffel, Evans, Hines, Massey (see THE MODEL ENGINEER, January 11th, 1923), Milnes and others.

A number of years ago, *English Mechanics* printed a fair amount of detail about Goyen and his work. Copies may be seen at most free libraries, and I will be glad to furnish the references upon hearing, through the Editor, from any interested reader.

Yours faithfully,

Liverpool. EDGAR H. REID.